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ABSTRACT

The Objective-Item Bank presented covers 16 sections of four subject areas in each of four grade levels. The four areas are: Language Arts, Math, Social Studies, and Science. The four grade levels are: Primary, Intermediate, Junior High, and High School. The Objective-Item Bank provides school administrators with an initial starting point for curriculum development and with the instrumentation for program evaluation, and offers a mechanism to assist teachers in stating more specifically the goals of their instructional program. In addition, it provides the means to determine the extent to which the objectives are accomplished. This document presents the Objective Item Bank for Junior High mathematics. (CK)

JUNIOR HIGH MATHEMATICS
BEHAVIORAL OBJECTIVES AND TEST ITEMS

EVALUATION FOR INDIVIDUALIZED INSTRUCTION

A Title III ESEA project
administered by
Downers Grove, Illinois
School District 99

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individualized instruction • inservice workshops to improve skills in evaluating new programs • pupil progress •

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	Lang. Arts	Math.	Soc. Stud.	Science
Primary				
Intermediate				
Junior High		X		
High School				

ED 066496

JUNIOR HIGH MATHEMATICS

BEHAVIORAL OBJECTIVES AND TEST ITEMS

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Evaluation for Individualized Instruction Project

AN ESEA TITLE III PROJECT

Administered

by

Downers Grove Public School District 99

BEHAVIORAL OBJECTIVE - TEST ITEM BANK

BACKGROUND

The Evaluation for Individualized Instruction Project, an ESEA Title III project administered by the Downers Grove, Illinois, School District 99, has developed an Objective-Item Bank covering sixteen sectors of four subject areas in each of four grade levels.

Subject Area

	LA	MA	SS	SC
1	11	12	13	14
2	21	22	23	24
3	31	32	33	34
4	41	42	43	44

LA = Language Arts
MA = Math
SS = Social Studies
SC = Science

1 = Primary
2 = Intermediate
3 = Junior High
4 = High School

Nearly 5000 behavioral objectives and over 27,000 test items based on these objectives were recently published as the culmination of this three-year project. The complete output of seventeen volumes totals over 4500 pages. These publications have been reproduced by the Institute for Educational Research to make them available at cost to teachers and administrators.

The objectives and items were written by over 300 elementary and secondary teachers, representing forty Chicago suburban school districts, who participated in workshops of three to nine weeks duration throughout the project. In these workshops they learned to write effective behavioral objectives and test items based on the objectives. The results of their work were edited for content and measurement quality to compile the largest pool of objectives and test items ever assembled.

PRINCIPLES AND MERITS

Unfortunately, the Objective-Item Bank is often viewed mainly as a source of test items. Although this is an important function, its greatest potential impact lies not in the availability of a multitude of test items, but rather in the ability of these items to measure carefully selected educational goals.

The almost frenetic search for test items on the part of some educators has been spurred by the current emphasis on measurement. Some educators have become so enamored with measurement that they seem more interested in obtaining a numerical index than examining what they are really trying to measure. Further, it is not unusual for teachers to speak about a child obtaining a score of 95% on a particular test. Frequently, they encounter considerable difficulty in interpreting the real meaning of a score and are content to just accept its numeral value. A much more important question would seem to be: What are our goals of measurement? Unless we can answer this question precisely, the only real purpose that testing serves is to gather data concerning pupils to facilitate the marking of report cards. This is not to say that this function is not legitimate - it is rather to say that such a view of measurement is much too constricting. The goal of measurement should be to provide feedback both to the teacher and the child regarding the success or failure of the learning experiences in realizing specifically stated objectives.

One of the main strengths of the EII Objective and Item Bank is that all the items are directly tied to specifically stated objectives. Each group of items is designed to measure a specific objective and therefore provides the means whereby the teacher can obtain feedback on the success of the educational program.

It is disheartening to observe so many districts attacking the complex problem of curriculum development independently. One cannot help reflecting on the mammoth duplication of efforts involved. The Objective-Item Bank offers a possible alternative to this duplication. Utilizing its resources, the curriculum committee is provided with some point of departure. The efforts of three hundred teachers participating in the Evaluation Project's workshops and the thoughts of forty districts can be evaluated and utilized. This is not to suggest that any set of objectives should be viewed as the "answer" to an individual district's curricular problem but rather the efforts of others offer a convenient point of departure and may serve to stimulate diverse opinions about the direction of curricular thrust within the individual district. The words of Sir Isaac Newton seem appropriate; "If I have seen further, it is by standing upon the shoulder of giants." The efforts of others, whether we consider them giant-like or pygmyish, do offer a threshold to view the immense, complicated problem of curricular development in better perspective.

The title of an article in a recent educational journal, "If You're Not Sure Where You're Going, You're Liable to End up Someplace Else," succinctly describes a continuing dilemma in our educational system. The vagueness of our goals often promotes the idea that "anything goes." Without a guiding beacon many classrooms become activity-centered rather than goal-oriented. One educator recently compared the all-too-typical classroom with Henry Ford's observation concerning history. He defined history as, "One damned thing after another." Is this true of the succession of activities within our classrooms? Does the teacher really know the educational purpose of each activity? Perhaps, even more importantly, do the children know the purpose?

The Objective-Item Bank offers a mechanism to assist teachers in stating more specifically the goals of their instructional program and further provides the means to determine the extent to which the objectives are accomplished. The specification of goals assists the teacher in discovering whether favored activities advance learning, or are merely time fillers; whether they get the "materials" across, or are merely perfunctory exercises.

Much discussion has been devoted to the topic of "*why* individualized instruction?" and occasionally some dialogue has even centered on the "*how*." But an even more basic question is one that is often ignored: "Individualize *what*?"

Many school districts mention their individualized programs in reading or mathematics. What is individualized within these programs? Are certain skills definitely identified? Is the practice of pretesting to determine the child's level of proficiency when he enters the program a guideline?

The Objective-Item Bank has two potential contributions to make to all school districts embarking on or presently engaged in individualized instruction programs. These contributions are: 1. A group of well-specified objectives which could form the "what" of the program. 2. A set of items designed to provide information on the degree of mastery of the objective.

APPLICATIONS AND TECHNIQUES

The versatility of the Objective-Item Bank is evident in the value and usability by both teachers and administrators.

To the Administration the Objective-Item Bank:

1. Provides an initial starting point for curriculum development. The existence of many objectives avoids the necessity of each district duplicating the efforts of another. The task of the curriculum committee becomes one of selecting and/or rejecting objectives from the Objective - Item Bank and then supplementing them with objectives developed at the local level. Past-participants of the Evaluation Project workshops would be valuable resource people in this endeavor.

2. Provides the instrumentation for program evaluation. The selection of items from those objectives representative of the main emphases of the local district provides the framework for the evaluation of the stated goals.

To the Teacher the Objective-Item Bank:

1. Provides the pooling of talent and imagination of teachers of varied experience and interests, thus avoiding the present duplication of effort.

2. Provides resources for more highly sensitized program evaluation instead of a battery of standardized tests. Since the objectives are tailored to the program, the associated test items can be used to determine precisely the efficacy of the instructional materials.

3. Provides the means whereby the teacher can become more acutely aware of that which he is seeking to have occur in his classroom and that which he will accept as evidence of its occurrence. Hopefully, as teachers become more aware of their goals, they will share these

objectives with children and let the pupils become acutely aware of that which is expected of them, ergo allowing them to seek their own modality of instruction for the realization of the stated goals.

4. Provides the nucleus of an individualized instruction program.

   a. It provides for more precise curriculum planning by differentiating those goals specific to each grade and even to each student. With the bank at their disposal, teachers are encouraged to become aware of their responsibilities in developing a set of basic objectives which every child must attain and a further set which can be pursued according to the students' abilities and interests.

   b. It provides several items per objective, some of which may be used as a pre-test to discover whether a student should undertake that objective while the remainder may be employed to measure the mastery of those students who do tackle the objective.

NOTES

Several of the volumes have been reproduced from punched cards by the IBM 407, a machine which does not print all characters exactly as they appear on a typewriter. Thus:

% is actually (

⌑ is actually)

0 is actually ? or !

Apostrophes cannot be printed.

The number immediately after the statement of each objective represents the number of items measuring attainment of that objective.

Information on the EII publications or purchase requests can be directed to:

INSTITUTE FOR EDUCATIONAL RESEARCH
1400 West Maple Avenue
Downers Grove, Illinois 60515

JUNIOR HIGH MATHEMATICS

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DEFINITIONS AND RULES

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF THE SYMBOLS OF MATHEMATICS AND THE IDEAS THE SYMBOLS REPRESENT BY IDENTIFYING STATEMENTS WHICH REFER TO THE RELATIONSHIP BETWEEN SYMBOLS AND IDEAS. 0173

The relationship between a numeral and number is 0515

a. the same as the relationship between the concrete and the abstract.
b. represented by the statement, $2 + 3 = 5$.
c. different than the relationship between my name and myself.
*d. similar to the relationship between the word "school" and my idea of the school I attend.

THE STUDENT WILL APPLY THE CRITERIA OF CONSISTENCE, REASONABLENESS, AND USEFULNESS IN EVALUATING A DEFINITION AS EVIDENCED BY HIS ABILITY TO IDENTIFY CONSISTENT, REASONABLE, AND USEFUL EVIDENCE SUPPORTING THAT DEFINITION. 0201

Select the alternative which correctly matches the definition with evidence that is consistent, reasonable, and useful. 0558

a. Definition: The sum of two negative integers is equal to the opposite of the sum of their absolute values.

Evidence:
1) We can represent addition of two positive integers on the number line by starting at the origin and counting unit intervals to the right, so....
2) $7 + 8 = |-7| + |-8| = |15|$
$-7 + -8 = (|-7| \div |-8|) = -15$
3) To keep a record of how many basketball games were lost from season to season.

b. Definition: The sum of a whole number and a negative integer is positive or negative according to the integer with the greater absolute value.

Evidence:
1) The absolute value of the sum of a non-negative integer and a negative integer is the whole-number difference in the absolute values of the addends.
2) $|-28 + 3| = |-28| - |3|$
$= 28 - 3$
$= 25$ since $|-28| > |3|$ the sum is negative
3) To represent the balance if deposits of \$150, \$200, \$50 are made in an account and withdrawals are made of \$70, \$80, and \$130.

c. Definition: The product a x b of two integers a and b, one of which is negative and the other a whole number, is given by a x b = -(/a/ x /b/)

Evidence:
1) ba = ab
2) The continuation of number patterns encourages this definition.

ex.	
20 = 4x5	-5 = -1x5
15 = 3x5	-10 = -2x5
10 = 2x5	-15 = -3x5
5 = 1x5	
0 = 0x5	

3) John had deposited $3 per week in his savings for four weeks. He now has $48. To represent how much he will have in his account two weeks hence write $38 plus (-2x$3) equal $32.

*d. Definition: The product of a x b if two negative integers a and b is given by a x b =/a/ x /b/

Evidence:
1) (8 + -5) (6 + -2) = 2 x (-5 x -2)
3 x 4 = ?
2) ${}^{o}5 \times 2 = {}^{o}(5 \times {}^{o}2)$
${}^{o}5 \times 2 = {}^{o}(5 \times 2)$
but $5 \times 2 = {}^{o}(5 \times 2)$
${}^{o}[{}^{o}(5 \times 2)] = 5 \times 2$ so we would like to write
${}^{o}5 \times {}^{o}2 = 5 \times 2$
3) Tom has writhdrawn $6 from his savings account each week for 4 weeks. He now had $38 in the account. How much did he have in the account 2 weeks ago.
$38 plus (-2 x -5) = $48.

THE STUDENT WILL DEMONSTRATE ABILITY TO ANALYZE RULES BY SELECTING FROM A LIST ONE THAT IS NOT ALWAYS VALID. 0210

Which of the following rules will not always provide a way of determining whether a certain number N has a certain number F as a factor? F is a factor of N if 0570

a. F = 2 and N ends in 0,2,4,6, or 8
b. F = 3 and the sum of N's digits is divisible by 3.
*c. F = 4 and N ends in 0,2,4,6, or 8
d. F = 5 and N ends in 0 or 5
e. F = 10 and N ends in 0

THE STUDENT WILL EVALUATE A CONCLUSION GIVEN ITS REASONING BY SELECTING THE MOST ADEQUATE DATA TO SUPPORT A GIVEN CONCLUSION. 0214

Which of the following conclusions is probably based on the most adequate data to support that conclusion? 0574

	Conclusion	Proof
a.	All bananas weigh between 3 and 25 ounces.	Actual weights of 100 bananas tested ranged from 3 to 25 ounces.
b.	The sun is 92×10^6 miles away.	The brightest student in the 8th grade said so.
c.	This room is 265 rubber bands long.	Three boys measured it using three different rubber bands.
*d.	All boys in this class weigh over 100 pounds.	On a new scale the boys all weighed themselves. The lightest one registered 108 pounds.
e.	The moon has a greater diameter than the sun.	Joe states that anyone can look and see that the moon is bigger than the sun.

THE STUDENT WILL SHOW HIS ABILITY TO ANALYZE A CERTAIN RELATIONSHIP FOR A GENERAL RULE BY SELECTING THE STEPS INVOLVED IN FORMULATING THAT RULE OR THE RESULTS OF APPLYING IT. 022

READ: A new football league was recently formed, and it was important that each team play each other team once per season. The director, in trying to determine the total number of games which had to be played per season, noted these facts:

# Teams involved	# Games required
2	1
3	3
4	6
5	10

In order to compute the number of games required as specified above for any given number of teams, it would probably be most efficient for the director to 0610

a. reason that for a given number of teams, there will be about twice that number of games.
*b. find some valid function rule relating the number of teams and the number of games.
c. diagram the teams and required games and then count the games.
d. limit each team to eight games.

Which of the following is true? 0611

a. for 12 teams, the director will need 56 games
b. for 13 teams, the director will need 66 games
c. for 14 teams, the director will need 77 games
*d. for 15 teams, the director will need 105 games
e. for 16 teams, the director will need 122 games

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SETS

THE STUDENT WILL SHOW THE ABILITY TO COMPREHEND THE DEFINITION OF A SET BY SELECTING THE CORRECT DESCRIPTION OF A GIVEN SET. 0107

Select the description that best fits all of the members of the set: {Alaska, California, Hawaii, Oregon, Washington} 0294

a. Five states of the United States
*b. All the states that border on the Pacific Ocean
c. All of the Western states
d. Five states west of the Mississippi

Select the description that best fits all of the members of the set: {13, 15, 17} 0295

a. three odd numbers
b. three whole numbers
c. three prime numbers
d. the prime numbers between 12 and 18
*e. the odd numbers between 12 and 18

Source: Silver-Burdett
Found. of Secondary School Math., Part I, pp. 3 and 4

THE STUDENT WILL SHOW THE ABILITY TO COMPREHEND THE DEFINITION OF SETS BY SELECTING THE CORRECT LISTING OF ELEMENTS FROM A GIVEN DESCRIPTION. 0108

Select the correct listing of elements for the set of even natural numbers. 0296

*a. {2,4,6,8,10,12}
b. {0,2,4,6,8,10,12}
c. {2,4,6,8,10,12}
d. {0,2,4,6,8,10,12}
e. {2,4,...10,12}

Select the correct listing of elements for the set of whole numbers such that each number is one more than a multiple of 5. 0297

- a. $\{6, 11, 16, \ldots\}$
- b. $\{6, 11, 16\}$
- *c. $\{1, 6, 11, 16, \ldots\}$
- d. $\{6, 11, 1, 16, 25, 21\}$
- e. $\{1, 6, 11, 16\}$

Source: Silver-Burdett, Found. of Secondary School Math, Part I, pp. 3 and 4.

THE STUDENT WILL RECOGNIZE SYMBOLS USED IN DEFINING A SET BY SET BUILDER NOTATION BY IDENTIFYING THE CORRECT TRANSLATIONS OF A GIVEN SET. 0133

> Set builder notation is a way of designating a set that uses a combination of words and symbols. In set builder notation the set of all the whole numbers is written as
>
> $$\{a \mid a \text{ is a whole number}\}$$
>
> and is read as "the set of all a such that a is a whole number."

Which of the following is a correct reading of $\{b \mid 2 < b < 10\}$? 0359

- a. The set of all b such that b is even.
- b. The set of all b such that b is an even number between 2 and 10.
- *c. The set of all b such that b is a number between 2 and 10.
- d. The set of all b such that b is a whole number between 2 and 10.
- e. The set of all b such that b is greater than or equal to 2 and less than or equal to 10.

Which of the following describe the set of whole numbers up to and including 10? 0360

I. $\{a \mid 0 \leq a \leq 10\}$
II. $\{a \mid a < 10\}$
III. $\{a \mid 0 < a \leq 10\}$
IV. $\{0 \mid a < 10$ and a is a whole number$\}$
V. $\{a \mid a$ is less than 10 and a is a whole number.$\}$

a. I, III and IV
b. IV and V
c. I and II
*d. I, IV and V
e. II and III

Source: Silver-Burdett, Found. of Secondary School Math-Part I,
p. 190-191.

THE STUDENT WILL ANALYZE A STATEMENT ABOUT A GIVEN SET BY STATING WHETHER OR NOT IT IS A GENERALIZATION FOR THAT SET. 017

Given the set of numbers $T = \{3,5,7,9,11\}$ which of the following statements is a generalization for that set. 0521

a. a 3
b. $b + 9$ is not a member of the set
c. $n + 2$ is a member of the set
*d. $y + 0 = y$

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF SETS BY SELECTING THE ONE WELL-DEFINED SET FROM AMONG SEVERAL DESCRIPTIONS. 0106

Which of the following is a set? 0292

a. The first seven lucky numbers.
b. The seven lucky numbers.
c. The tall boys in the seventh grade.
*d. The ten tallest boys in the seventh grade.

Which of the following is a set? 0293

a. The large states of the United States.
b. The northern states of the United States.
*c. The first fifteen prime numbers.
d. Fifteen prime numbers.

Silver Burdett, Found. of Secondary School Math, Part I, pp. 1 and 2.

THE STUDENT WILL BE ABLE TO ANALYZE EQUAL AND EQUIVALENT SETS BY FINDING A SET THAT IS EQUIVALENT TO A GIVEN SET AND A SET THAT IS EQUAL TO THE SAME SET. 0105

Given the following sets: 0290

A = the set of whole numbers less than nine
B = 1,2,3,4,5,6,7,8
C = 2,4,6,8,10,12,14,16
D: the set of even natural numbers less than seventeen
E = 0,1,2,3,4,5,6,7,8

Which of the following is true?

a. B is equivalent to E
b. A is equivalent to B
*c. B is equivalent to D
d. C is equivalent to A
e. A is equivalent to D

Given the following sets: 0291

A: the set of whole numbers less than nine
B = 1,2,3,4,5,6,7,8
C = 2,4,6,8,10,12,14,16
D: the set of even natural numbers less than seventeen
E = 0,1,2,3,4,5,6.7,8

Which of the following is true?

a. A=B
*b. E=A
c. D=A
d. B=E
e. E=C

Source: Silver Burdett, Found. of Secondary School Math, Part I, pp. 5 and 6.

THE PUPIL WILL DEMONSTRATE HIS UNDERSTANDING OF THE MEANING OF CARDINAL NUMBERS BY PREDICTING WHEN TWO SETS HAVE THE SAME CARDINAL NUMBER. 0109

Which of the following is not required in order that two sets have the same cardinal number? 0298

a. The elements can be put in one-to-one correspondence.
b. The two sets have exactly the same elements.
c. The two sets have exactly the same number of elements.
*d. The elements of one set can be matched with those of the other set with one element left over.
e. The whole number for each set is the same.

A has the same cardinal number as B, where A and B are sets of numbers if and only if which of the following conditions are true? 0299

1. $n(A) = n(B)$
2. $A = B$
3. A is equivalent to B
4. $n(A) \neq n(B)$
5. $A \neq B$

a. 1 and 2
*b. 1 and 3
c. 2 and 3
d. 2 and 4
e. 3 and 5

Source: Silver-Burdett, Found. of Secondary School Math., Part I, pp. 6,7,8.

THE STUDENT WILL SHOW HIS KNOWLEDGE OF THE EMPTY SET BY IDENTIFYING ITS SYMBOLS AND THE CORRECT CONCEPTS CONCERNING EMPTY SETS. 0136

Which of the following is a correct notation for the empty set? 0365

I. 0
II. 0
III. ∅
IV. ∅
V.

a. II and III
b. I and III
c. IV and V
d. II and IV
*e. III and V

Which of the following statements is true? 0366

a. ∅ is the empty set
b. The empty set is a proper subset of every set.
*c. The empty set is a proper subset of every set except itself.
d. Two of the symbols for empty set are 0 and 0.
e. A set is a collection of objects and therefore a set cannot be empty.

Source: Silver-Burdett, Found. of Secondary School Math--Part I, p. 5.

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF COMPLEMENT AND ORDER OF OPERATIONS BY DETERMINING THE RELATIONSHIPS BETWEEN SETS. 0118

If $A = \{a, b, c, d, e, f, g, h\}$ 0316
$B = \{a, b, e, f\}$
$C = \{a, b, c, d\}$
Which of the following is true?

a. $\overline{B \cap C} = \{c, d, e, f\}$
b. $\overline{B \cup C} = \{a, b\}$
*c. $\bar{B} \cap \bar{C} = \{g, h\}$
d. $\bar{B} \cup \bar{C} = \{c, d, g, h\}$
e. $B \cup \bar{C} = \{a, b, g, h\}$

If $A = \{a, b, c, d, e, f, g, h\}$ 0317
$B = \{a, b, c, d\}$
Which of the following is NOT true?

a. $\overline{B \cup C} = \bar{B} \cap \bar{C}$
b. $B \cup C = A$
c. $\overline{B \cap C} = \bar{B} \cup \bar{C}$
d. $\overline{B \cup C} = \emptyset$
*e. $\overline{B \cap C} = \bar{B} \cap \bar{C}$

Source: Silver Burdett Co., Found. of Secondary School Math, Part I, pp. 16, 17, 18.

THE STUDENT CAN DEMONSTRATE KNOWLEDGE OF DISJUNCTION AND CONJUNCTION BY IDENTIFYING THEIR DEFINITIONS. 0068

A statement which is formed by joining two statements by the word or is called 0106

a. combination
b. conjunction
c. intersection
*d. disjunction

A conjunction is true if 0107

- *a. both statements are true
- b. one statement is true and one is false
- c. both statements are false
- d. at least one statement is true
- e. at least one statement is false

Source: Dolciani - Algebra 1, Chapter 1.

THE STUDENT WILL ANALYZE A GIVEN SET OF RULES TO DIVIDE A SET INTO TWO DISJOINT SUBSETS BY IDENTIFYING A RULE FOR THIS PROCEDURE. 0226

Which of the following rules would divide the set of all simple closed curves into two disjoint subsets? 0596

- a. If it has a point sticking out it is convex.
- b. If the only way to connect a point inside it with one outside it is by intersecting a boundary, it is convex.
- c. If the only way to connect a point inside it with one outside it is by intersecting a boundary, it is concave.
- *d. If there are any 2 points on the boundary that can be connected by a segment lying partly outside the figure, it is concave.
- e. If there are any sharp curves, it is concave.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE DEFINITION OF SUBSETS TO DECIDE IF GIVEN SETS ARE SUBSETS OF EACH OTHER. 0112

If $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 3, 4\}$ and $C = \{2, 4, 5\}$ which of the following is true? 0304

- a. $A \subset B$
- *b. $B \subset A$
- c. $A \subset C$
- d. $B \subset C$
- e. $C \subset B$

If $A = \{1, 2, 3, 4, 5\}$, which of the following is NOT a subset of A? 0305

- a. $\{1, 2, 3, 4, 5\}$
- b. The set of three, four and five
- *c. The set of the first five whole numbers
- d. $\emptyset$
- e. The whole numbers from 1 thru 5.

Source: Silver Burdett, Found. of Secondary School Math, I, pp. 12-13.

THE STUDENT WILL SHOW HIS UNDERSTANDING OF THE MEANING OF SUBSETS AND PROPER SUBSETS BY STATING WHICH STATEMENTS ABOUT A SITUATION INVOLVING SUBSETS ARE CORRECT. 0132

If the subsets of the set $A = \{3,6,9,12\}$ are given as $\{3,6,9,12\}, \{3\}, \{6\}, \{9\}, \{12\}, \{3,6\}, \{3,9\}, \{3,12\}, \{6,9\}, \{6,12\}, \{9,12\}, \{3,6,9\}, \{3,9,12\}, \{6,9,12\}, \{3,6,12\},$. 0356

Which of the following statements are true?

I. $\{\ \}$ is a proper subset of A.
II. $\{3,6,9,12\}$ is a proper subset of A.
III. $\{\ \}$ is not a subset of A.
IV. $\{3,6,9,12\}$ is not a subset of A.
V. $\{3,6,9,12\} = A$.
VI. $\{3,6,9\}$ is equivalent to $\{3,6,12\}$

- a. I, II and V.
- b. III, IV, and V.
- c. III, IV, and VI.
- d. II, V and VI.
- *e. I, V and VI.

All of the subsets of set B = {a, b, c} are given as {c,a,b} ,{a}, {b} , {c} , {a,b} , {b,c} , . 0357

Which of the following statements are true?

- I. All of the above subsets are proper subsets of {a,b,c} .
- II. The subset {a,b,c} is missing from the list.
- III. There should be 8 subsets in all, so one is missing.
- IV. The empty set, { } , is a subset of set B.
- V. For any set of n elements, the number of subsets is 2^n.

- a. I and II
- b. II and IV
- c. I and III
- *d. III and V
- e. II and III

Bill Jones had a birthday this week. He hinted to his father that he would like to have a first baseman's glove or a box-seat to the next Cubs game. Mr. Jones gave Bill a large box on the morning of his birthday. Bill tried to guess what was in the box. It could be the glove. It could be the ticket. It could even be both the glove and the ticket. 0358

Bill has described subsets of the set glove, ticket . Which of the following is a true statement about these subsets?

- a. All of the subsets of the set glove, ticket were described by Bill.
- *b. Bill did not describe all of the subsets of the set {glove, ticket} . He left out the subset where the box is empty, that is ∅.
- c. {glove, ticket} , {glove} , {ticket} are all the proper subsets that there are for {glove, ticket} .
- d. Bill described more than the subsets of {glove, ticket} . He also described {glove, ticket} which is not a subset.
- e. {glove, ticket} , {glove} ,{ticket} are all the subsets there are for {glove, ticket} .

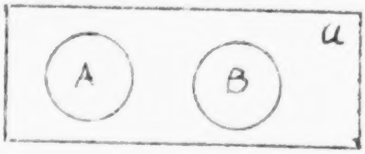
Source: Silver-Burdett, Found. of Secondary Math.-Part I., pp. 12 and 13.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF SET THEORY AND LANGUAGE BY INTERPRETING VENN DIAGRAMS REGARDING INTERSECTION AND UNION AND UTILIZING NOTATION REGARDING SETS. 0103

Directions: In the following exercises, choose the response that best completes the statement or answers the question.

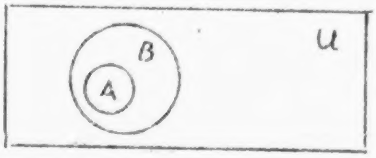
Set A and Set B are ________ sets. 0254

*a. disjoint
b. intersecting
c. equal
d. equivalent



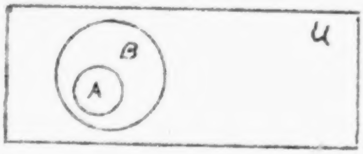
Set A is ____________ Set B. 0255

a. a proper subset of
b. equivalent to
c. equal to
*d. a subset of



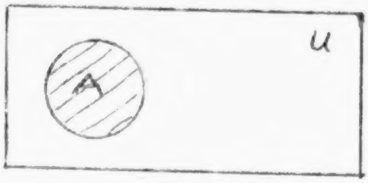
The intersection of Set A and Set B is ________. 0256

a. Set B
*b. Set A
c. $\emptyset$
d. a finite set



The unshaded portion of the Venn diagram is referred to as _______. 0257

a. C (A)
b. $\overline{A}$
c. the complement of A
*d. all of the above

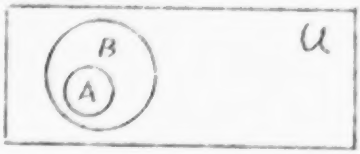


The complement of a set contains _________. 0258

a. all members of the set
*b. no members of the set
c. some members of the set
d. only one member of the set

The complement of set B contains ________. 0259

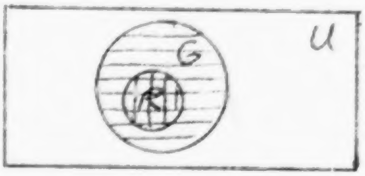
a. all members of set A
b. some members of set A
*c. no members of set A
d. members of $A \cap B$



Directions: In the Venn diagram, the universal set is all students in our school. Set G is the set of all girls in the school. Set R is the set of all red-haired girls in the school. In the following items, choose the best response.

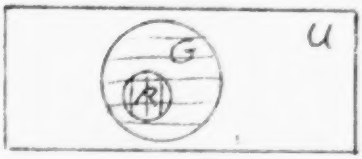
________ is the same as $R \cap G$. 0260

a. ∅
*b. R
c. G
d. the complement of R



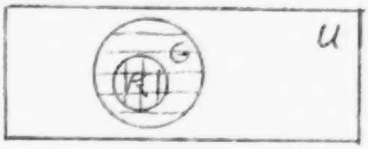
________ is the same as $R \cup G$. 0261

a. ∅
b. R
*c. G
d. the complement of G



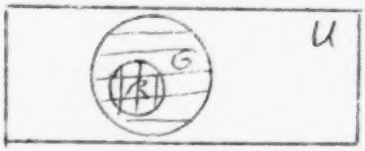
________ portion of the diagram represents the complement of G. 0262

a. The vertical shaded
b. The horizontal shaded
c. The cross-shaded
*d. The unshaded



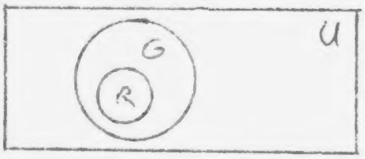
________ portion of the diagram represents the complement of R. 0263

a. The vertical shaded
b. The horizontal shaded
*c. The non-vertical shaded
d. The unshaded



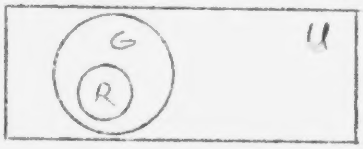
The complement of G ________ the complement of R. 0264

a. is equal to
*b. is a subset
c. is the complement of
d. none of the above



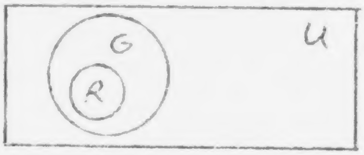
________ is the same set as the union of G and the complement of G. 0265

a. ∅
b. G
c. R
*d. the universal set



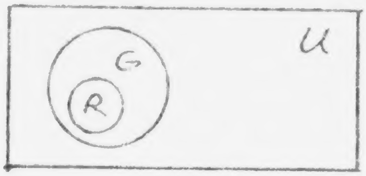
________ is the same set as the union of R and the complement of R. 0266

a. ∅
b. G
c. R
*d. the universal set



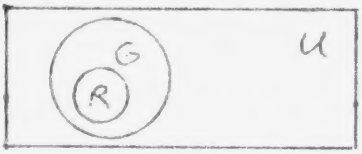
________ is the same set as the union of the complement of R and the complement of G. 0267

a. the universal set
b. R U G
*c. the complement of R
d. the complement of G



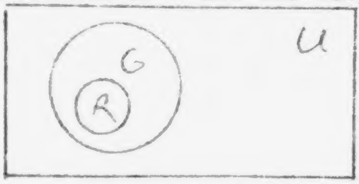
________ is the complement of the complement of R. 0268

*a. R
b. G
c. the universal set
d. the empty set



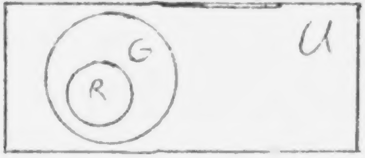
________ is the same set as the intersection of G and the complement of G. 0269

a. G
b. the complement of G
*c. the empty set
d. the universal set



________ is the same set as the intersection of the complement of R and the complement of G. 0270

*a. the complement of G
b. the complement of R
c. the empty set
d. the universal



Directions: For the following items it is given that the universal set is {1, 2, 3, 4, 5, 6, 7, 8, 9.}

Set R = {2, 4, 7, 9}
Set S = {1, 9}

C(R) means the complement of R
C(S) means the complement of S

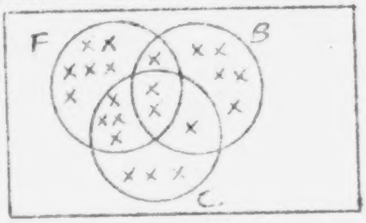
Match the letter of the items in column II with the items in column I.

Column I	Column II	
c C(R)	a. {1, 2, 4, 7, 9}	0271
e C(S)	b. {1, 2, 3, 4, 5, 6, 7, 8, 9}	0272
j $R \cap S$	c. {1, 3, 5, 6, 8}	0273
a $R \cup S$	d. {1, 3, 5, 6, 8, 9}	
i $C(R) \cap C(S)$	e. {2, 3, 4, 5, 6, 7, 8}	0274
h $C(R) \cup C(S)$	f. {1, 3, 5, 5, 9}	0275
b $C(R) \cup R$	g. {∅}	0276
g $S \cap C(S)$	h. {1, 2, 3, 4, 5, 6, 7, 8}	0277
b $R \cup C(S)$	i. {3, 5, 6, 8}	0278
d $S \cup C(R)$	j. {9}	0279

Seeing Through Mathematics, Van Engen, et al, Book II, pp. 20-24.

THE STUDENT WILL DEMONSTRATE THE ABILITY TO APPLY VENN DIAGRAMS TO THE INTERSECTION BETWEEN SETS BY SOLVING PROBLEMS INVOLVING RELATIONSHIPS BETWEEN TWO OR MORE SETS GIVEN THE VENN DIAGRAM OF THE SETS. 0111

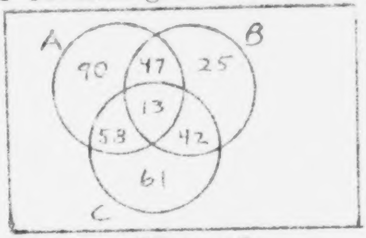
Let F be the football team of a certain school, B be the baseball team of that school, and C be the students who belong to the school's chess club. 0302



Which of the following is NOT true?

a. Six members of the football team belong to the chess club.
b. Three members of the baseball team belong to the chess club.
c. Three members of the baseball team are also on the football team.
*d. Three members of the chess club are on both the football and the baseball teams.
e. Two members of the chess club are on both the football and the baseball teams.

Let A be the set of seventh graders with blue eyes 0303
Let B be the set of seventh graders with brown hair
Let C be the set of seventh graders who wear glasses



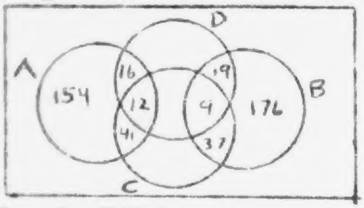
Which of the following is NOT true?

a. 60 seventh graders have blue eyes and brown hair
b. 71 seventh graders have blue eyes and wear glasses
c. 65 seventh graders have brown hair and wear glasses
d. 13 seventh graders have brown hair and blue eyes and wear glasses
*d. 113 seventh graders have brown hair and blue eyes and wear glasses

Source: Silver-Burdett, Found. of Secondary School Math., I, pp. 9,10,11

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO APPLY VENN DIAGRAMS BY USING VENN DIAGRAMS TO SOLVE PROBLEMS INVOLVING RELATIONSHIPS BETWEEN TWO OR MORE SETS.

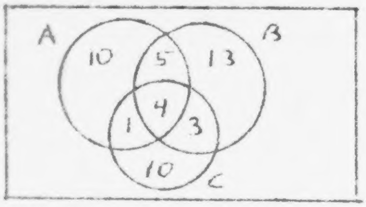
If A = set of seventh graders who are girls 0312
B = set of seventh graders who are boys
C = set of seventh graders who wear glasses
D = set of seventh graders who have brown eyes



Which of the following is NOT true?

- *a. 28 seventh grade girls wear glasses.
- b. 69 seventh grade girls have brown eyes and wear glasses.
- c. 56 seventh grade boys and girls have brown eyes.
- d. 99 seventh grade boys and girls wear glasses.
- e. There are 464 seventh grade students.

If A = students who take typing. 0313
B = students who take orchestra.
C = students who take photography.



Which of the following is true?

- a. 9 students take all three courses.
- b. 10 students take typing and orchestra.
- *c. 33 students take only one course.
- d. 8 students take photography.
- e. 26 students take orchestra and photography.

Source: Silver Burdett Co., Found. of Secondary Math. I, pp. 14, 15, 16.

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF THE RELATIONSHIP BETWEEN VENN DIAGRAMS AND SET ALGEBRA BY MATCHING STATEMENTS OF SET RELATION WITH THEIR CORRECT PICTORIAL REPRESENTATION. 0141

Match each operation below with its Venn diagram. After matching, which Venn diagram has NOT been used?

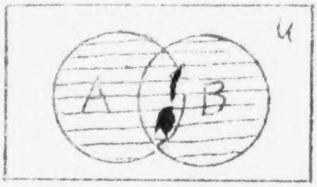
$\overline{A \quad B}$ *3 0379

$A \cup B$ *1 0380

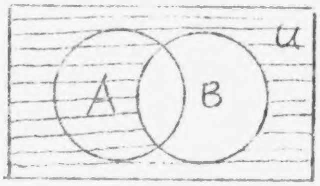
$A \cup \overline{B}$ *2 0381

$\overline{A} \cup \overline{B}$ *5 0382

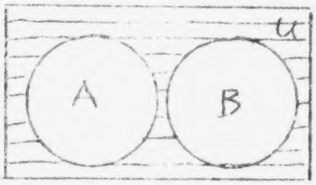
1



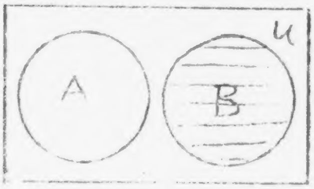
2



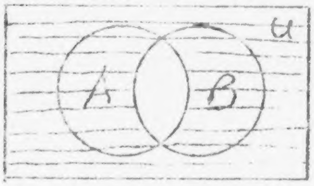
3



4



5



Not used: 0383

a. 1
b. 2
c. 3
*d. 4
e. 5

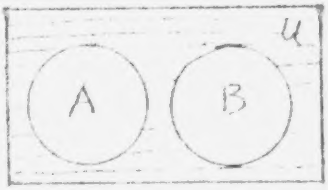
Match each operation below with its Venn diagram. After matching, which Venn diagram has NOT been used?

$\overline{A} \cap B$ *5

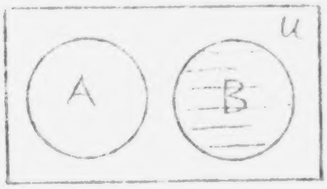
$A \cap \overline{B}$ *2

$A \cap B$ *3

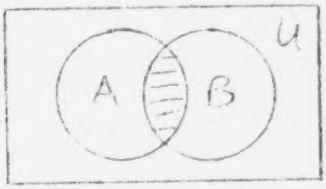
$\overline{A \cap B}$ *4

1


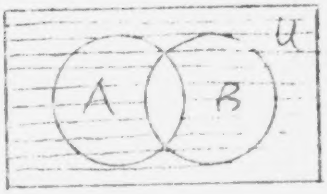
0384

2


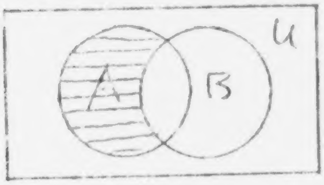
0385

3


0386

4


0387

5


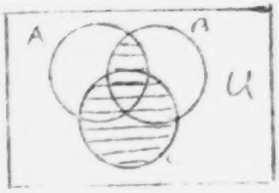
Not used:

0388

*a. 1
b. 2
c. 3
d. 4
e. 5

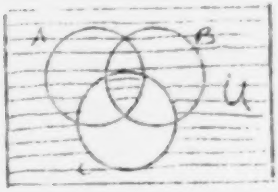
Match each operation below with its Venn diagram. After matching, which Venn diagram has NOT been used?

$\overline{A \cap (B \cup C)}$ *5

1


0389

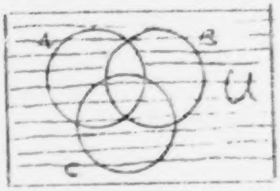
$(A \cap B) \cup C$ *1

2


0390

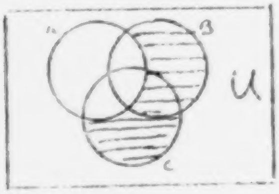
$\overline{A} \cap (B \cup C)$ *4

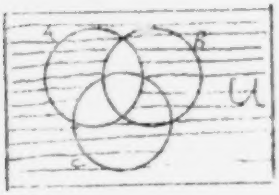
0391

3


$(A \cap B) \cup \overline{C}$ *2

0392

4


5


Not used:

0393

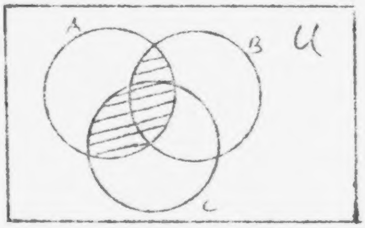
a. 1
b. 2
*c. 3
d. 4
e. 5

Source: Found. of Secondary School Math—Part I, Silver-Burdett, Ch. 1.

THE STUDENT WILL ILLUSTRATE HIS UNDERSTANDING OF IDENTITIES IN SET ALGEBRA AND THE USE OF VENN DIAGRAMS TO REPRESENT IDENTITIES BY SELECTING BOTH THE LEFT AND RIGHT HAND SIDE OF AN IDENTITY FROM ITS DIAGRAM. 0142

Which two of the following pairs of set relationships are illustrated by this Venn diagram. 0394

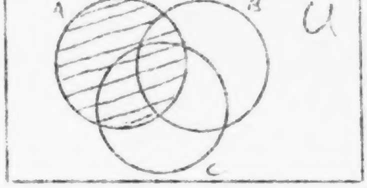
1. $A \cap (B \cap C)$
2. $A \cap (B \cup C)$
3. $(A \cap B) \cup (A \cap C)$
4. $A \cup (B \cap C)$
5. $(A \cap B) \cap C$
6. $(A \cup B) \cap (A \cup C)$



a. 1 and 5
*b. 2 and 3
c. 4 and 6
d. 2 and 6
e. 3 and 5

Which of the following pairs of set relationships are illustrated by this Venn diagram? 0395

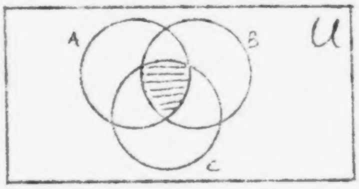
1. $\overline{A} \cap \overline{B} \cap \overline{C}$
2. $A \cup (B \cup C)$
3. $\overline{A \cap B \cap C}$
4. $A \cup (B \cap C)$
5. $(A \cup B) \cup C$
6. $(A \cup B) \cap (A \cup C)$



a. 3 and 5
b. 1 and 3
c. 2 and 6
d. 2 and 5
*e. 4 and 6

Which of the following pairs of set relationships are illustrated by this Venn diagram? 0396

1. $A \cap (B \cap C)$
2. $\bar{A} \cap \bar{B} \cap \bar{C}$
3. $A \cup (B \cup C)$
4. $A \cap (C \cap B)$
5. $\overline{A \cap B \cap C}$



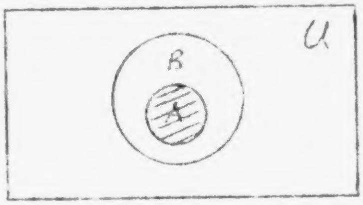
a. 2 and 5
b. 3 and 5
*c. 1 and 4
d. 2 and 3
e. 3 and 4

Source: Found. of Secondary School Math, part I., Silver-Burdett, Chapter 1.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF SET ALGEBRA AND THE USE OF VENN DIAGRAMS TO ILLUSTRATE THIS ALGEBRA BY SELECTING THE ONE CASE THAT IS NOT PICTURED BY A GIVEN VENN DIAGRAM. 0143

Which of the following relationships is NOT illustrated by this Venn diagram? 0397

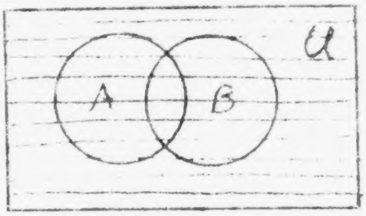
1. $A \subset B$
2. $A \cap U$
3. $A \cup U$
4. $A \cap A$
5. $A \cup A$



a. 1
b. 2
*c. 3
d. 4
e. 5

Which of the following relationships is NOT illustrated by this Venn diagram? 0398

1. $A \cup \bar{A}$
2. $A \cup U$
3. U
4. $\emptyset$
5. $B \cup \bar{B}$



a. 1
b. 2
c. 3
*d. 4
e. 5

Source: Found. of Secondary School Math.--Part I.

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF THE RELATIONSHIP BETWEEN THE OPERATION OF ADDITION OF WHOLE NUMBERS AND OPERATIONS WITH SETS BY SELECTING THE ANSWER TO COMPUTATIONAL PROBLEMS THAT USE THIS RELATIONSHIP. 0123

Given the following sets: 0326

$A = \{4, 6, 8\}$ $B = \{a, b, c\}$ $C = \{6, 8, 10\}$
$D = \{\text{alpha, beta, gamma}\}$ $E = \{a, 6, 8\}$
Which of the following is NOT a correct statement?

a. $n(A) + n(B) = 6$
b. $n(C \cup D) = 6$
c. $n(B \cap E) = 1$
*d. $n(B \cap C) = \emptyset$
e. $n(A \cap B) + n(E) = 3$

Given the following sets: 0327

A = {4, 6, 8} B = {a, b, c} C = {6, 8, 10}
D = {alpha, beta, gamma} E = {a, 6, 8}
Which of the following is NOT true?

a. $n(A) + n(D) > n(D)$
b. $n(A) - n(B) = n(B \cap D)$
c. $n(A \cup C) < n(A) + n(C)$
*d. $n(A) + n(D) + n(E) < n(A \cup D \cup E) + n(A \cap E)$
e. $n(C \cup E) + n(C \cap E) = n(C) + n(E)$

Source: Silver Burdett Co., Found. of Secondary School Math, Part I, pp. 19, 20, 21.

THE STUDENT WILL ANALYZE A PROPERTY FOR AN OPERATION ON SETS IN THE LIGHT OF TWO DIFFERENT DEFINITIONS OF THE OPERATION AND INDICATE THE DEFINITION UNDER WHICH THE PROPERTY HOLDS. 0131

Look at the following two definitions of Cartesian products formed from 3 sets, A, B and C. 0353

I. The set of all possible ordered pairs that can be formed by using an element of the first set as the first component and an element of the second set as a second component.

II. The set of all possible ordered triplets that can be formed by using an element of the first set as the first component, an element of the second set as the second component and an element of the third set as a third component.

According to which of these definitions is it true that $(A \times B) \times C = A \times (B \times C)$?

a. I only
*b. II only
c. both I and II
d. neither I nor II
e. II always and I sometimes

Look at the following two definitions of an operation called "difference" and indicated by * on two sets A and B. 0354

I. The set of all elements formed from the members of the first set that are not members of the second set.

II. The set of all elements formed from the members of the larger set that are not members of the smaller set.

According to which of these definitions is it true that A * B = B * A?

a. I only
*b. II only
c. both I and II
d. neither I nor II
e. II always and I sometimes

Look at the following two definitions of an operation called "difference" and indicated by * on two sets A and B. 0355

I. The set of all elements formed from the members of the first set that are not members of the second set.

II. The set of all elements formed from the members of the larger set that are not members of the smaller set.

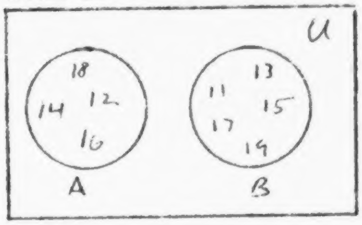
According to which of these definitions is it true that A * (B * C) = (A * B) * C?

a. I only
b. II only
c. both I and II
*d. neither I nor II
e. II always and I sometimes

Source: Silver-Burdett, Foundation of Secondary Math-Part I, Ch. 1.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE RELATIONSHIP BETWEEN THE OPERATION OF ADDITION IN THE SET OF WHOLE NUMBERS AND THE OPERATIONS WITH SETS, BY STATING WHICH CONDITIONS REGARDING SET CARDINAL NUMBERS, UNION AND INTERSECTION ARE TRUE. 0135

In this Venn diagram, U represents the set of whole numbers, A is the set of even natural numbers from 10 to 20 and B is the set of odd natural numbers from 10 to 20. 0363

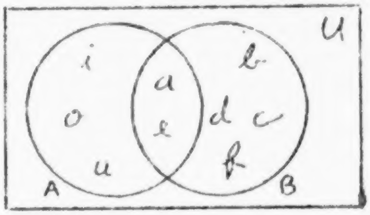


I. Cardinal number of Set A is 4 and Set B is 5.
II. $n(A \cup B) = 9$
III. $A \cup B = \{11,12,13,14,15,16,17,18,19\}$
IV. $A \cap B = \emptyset$
V. $n(A) + n(B) = n(A \cup B)$

Which of the following are true?

*a. I, II, III, IV and V
b. I, III, IV and V
c. I, II, III and V
d. I, II, III and IV
e. II, III, IV and V

In this Venn diagram, the Cardinal number of Set A is 5 and the Cardinal number of Set B is 6. U is the set of the alphabet. 0364



I. $A \cap B = \{a,e\}$
II. $n(A \cup B) = 9$
III. $n(A) + n(B) = 11$
IV. $n(A) + n(B) = n(A \cup B)$
V. $n(A) + n(B) = n(A \cup B) = n(A \cap B)$

Which of the following are true?

- a. I, II, III, IV and V
- b. I, III, IV and V
- *c. I, II, III and V
- d. I, II, III and IV
- e. II, III, IV and V

Source: Silver-Burdett, Foundations of Secondary School Math-Part I, Ch. 1.

THE STUDENT WILL USE UNION, INTERSECTION, OR CARTESIAN PRODUCTS TO ARRIVE AT AN IDENTITY IN THE ALGEBRA OF SETS BY SELECTING A SERIES OF OPERATIONS THAT WILL YIELD THE SAME SET AS A GIVEN SERIES OF OPERATIONS. 0139

Directions: Look at the following sets:
$A = \{1,2\}$ $B = \{2,3\}$ $C = \{4,5\}$

Given $A \cup B = \{1,2,3\}$ and $C \times (A \cup B) = \{(1,4), (1,5), (2,4), (2,5), (3,4), (3,5)\}$ 0371
Using union, intersection, and Cartesian products on the above three sets, A, B, and C, how would you find the set $\{(1,4), (1,5), (2,4), (2,5), (3,4), (3,5)\}$ another way?

- a. $(C \cup A) \times B$
- b. $(C \times A) \cup B$
- c. $(C \times A) \cup (B \times A)$
- d. $(C \cap A) \times (C \cap B)$
- *e. $(C \times A) \cup (C \times B)$

Look at the following three sets:
$A = \{a,b,e,f\}$ $B = \{a,b,c,d\}$ $C = \{b,d,e,g\}$

Given $A \cap (B \cup C) = \{a,b,e\}$ 0372
Using only union and intersection on the above three sets, A, B, and C, how would you find the set $\{a,b,e\}$ another way?

- a. $(A \cap B) \cup C$
- b. $A \cup (B \cap C)$
- c. $A \cap (B \cap C)$
- *d. $(A \cap B) \cup (A \cap C)$
- e. $(A \cup B) \cap (A \cup C)$

Given $A \cup (B \cap C) = \{a,b,e,f,d\}$
Using only union, and intersection on the above three sets, A, B, C, how would you find the set $\{a,b,e,f,d\}$ another way? 0376

a. $(A \cup B) \cap C$
b. $A \cap (B \cap C)$
*c. $(A \cup B) \cap (A \cup C)$
d. $(A \cap B) \cup (A \cap C)$
e. $(A \cap B) \cap (A \cap C)$

Source: Found. of Secondary School Math—Part I, Silver-Burdett, Chap. 1.

THE STUDENT WILL APPLY THE CONCEPTS OF SET ALGEBRA TO A NEW SET SITUATION BY INDICATING A RELATIONSHIP BETWEEN SETS WHEN GIVEN SOME INFORMATION ABOUT THAT RELATIONSHIP. 0137

Given that $A \cap B = A$, what is true about the relationship of A and B? 0367

a. $A = B$
b. A is equivalent to B
*c. $A \subset B$
d. $B \subset A$
e. $n(A \cup B) = n(A) + n(B)$

Given that $A \cup B = A$, what is true about the relationship between A and B? 0368

*a. $A = B$
b. A is equivalent to B
c. $A \subset B$
d. $B \subset A$
e. $n(A \cup B) = n(A) + n(B)$

Source: Found. of Secondary School Math—Part I, Silver-Burdett, Ch. 1.

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF THE CONCEPT OF INTERSECTION OF SETS BY SOLVING PROBLEMS INVOLVING SETS DEFINED BY DESCRIPTION AND/OR SETS DEFINED BY LISTING. 0110

Let $A = \{3, 6, 9, 12, 15, \ldots\}$
$B = \{5, 10, 15, 20, 25, \ldots\}$ and
$C = \{15, 30, 45, 60, 75, \ldots\}$

Which of the following is true? 0300

a. $A \cap B = \{15\}$
b. $B \cap C = \{15\}$
*c. $A \cap B = C$
d. $A \cap B = \emptyset$
e. $B \cap C = A$

Let U be the set of all the members of a club, M be the membership committee of U, and P be the program committee of U. Which of the following is true. 0301

a. $U \cap M = U$
*b. $U \cap M = M$
c. $U \cap P = \emptyset$
d. $M \cap P = P$
e. $U \cap M = \emptyset$

Source: Silver-Burdett, Found. of Secondary School Math-I, pp. 9,10,11

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE DEFINITIONS OF INTERSECTION AND SUBSETS TO GENERALIZE TWO LAWS OF SETS ALGEBRA, BY SELECTING A TRUE GENERALIZATION FROM AMONG A LIST OF GENERALIZATIONS. 0113

Which of the following is *always* true, no matter what elements are included in sets A and B? 0306

- a. $A \cap B = \emptyset$ and $B \cap A = \emptyset$
- b. If $A \cap B = \emptyset$ then $B \cap A = B$
- *c. $A \cap \emptyset = \emptyset$ and $B \cap \emptyset = \emptyset$
- d. If $A \cap B = A$, then $B \cap A = \emptyset$
- e. $B \cap A = A$ and $A \cap B = B$

Which of the following is *always* true, no matter what elements are included in sets A and B? 0307

- *a. If $A \supset B$, then $A \cap B = A$
- b. If $B \supset A$, then $A \cap B = A$
- c. If $A \supset B$, then $A \cap B = \emptyset$
- d. If $B \supset A$, then $A \cap B = \emptyset$
- e. If $A \supset B$, then $A \cap B = B$

Source: Silver-Burdett, *Found. of Secondary School Math*, I, pp. 12-13.

THE STUDENT WILL USE HIS KNOWLEDGE OF THE DEFINITION OF DISJOINT SETS TO IDENTIFY SETS WHOSE INTERSECTION IS THE EMPTY SET. 0114

Which of the following sets are disjoint sets? 0308

$A = \{2, 4, 6, 8, 10\}$ $B = \{1, 3, 6, 8, 9\}$
$C = \{10, 8, 6, 4, 2\}$ $D = \{6, 8\}$
$E = \{3, 9\}$ $F = \{6, 8, 10\}$

- a. A and C
- *b. D and E
- c. C and B
- d. D and F
- e. B and E

Which of the following pairs of sets have the empty set as the set that is their intersection? 0309

a. $\{1, 2, 3\};\{3, 6, 9\}$
b. $\{1, 2, 3\};\{0, 1, 2, 3\}$
c. $\{1, 2, 3\}$; Set of first three whole numbers
*d. $\{1, 2, 3\};\{1, 2, 3, 4, 5\}$
e. $\{1, 2, 3\}$; Set of first three natural numbers

Source: Silver Burdett Co., Found. of Secondary School Math-I, pp. 12-13.

THE STUDENT WILL USE HIS KNOWLEDGE OF THE PROPERTIES OF UNION OF SETS AND THE PROPERTIES OF ADDITION TO ARRIVE AT THE RELATIONSHIP BETWEEN THE TWO. 0115

If $A = \{1, 2, 3\}$, $B = \{4, 5, 6\}$ and $C = \{3, 5, 7, 9, 11\}$ and $n(A) + n(B) = n(A \cup B)$ and $n(A) + n(C) \neq n(A \cup C)$ which of the following is true? 0310

a. $A \subset B$
b. $A \subset C$
c. $A = B$
*d. $A \cap C = \emptyset$
e. $A \cap B = \emptyset$

If $A = \{1, 2, 3\}$, $B = \{3, 4, 5\}$ and $C = \{1, 2, 3, 4, 5\}$ which of the following is NOT true? 0311

a. $A \cup B = \{1, 2, 3, 4, 5\}$
b. $A \cup B = C$
c. $A \cup B = B \cup A$
d. $A \cup B = \{3, 4, 1, 2, 4\}$
*e. $A \cup B = n(A) + n(B)$

Source: Silver Burdett Co., Found. of Secondary School Math-I, pp. 14, 15, 16.

THE STUDENT WILL DEVELOP GENERALIZATIONS BASED UPON RELATING THE DEFINITIONS OF SUBSET, UNION, INTERSECTION, EMPTY SET AND COMPLEMENT BY IDENTIFYING THE RELATIONSHIP BETWEEN SETS GIVEN CERTAIN CHARACTERISTICS OF THAT RELATIONSHIP. 0117

Govem: 0314
1) $B \cup A = B$
2) $B \cap A = A$
3) $\overline{B} = \emptyset$
4) $\overline{\emptyset} = B$
5) B is the identity element for the operation of intersection.

Which of the following is true?

a. $B \subset A$
b. $A = \overline{B}$
*c. $A \subset B$
d. $A \cap B = \emptyset$
e. $\overline{A} = B$

Given: 0315
1) $A \cup B = B \cup A$
2) $(A \cup B) \cup C = A \cup (B \cup C)$
3) $A \cup \emptyset = A$
4) $B \cap C = \emptyset$
5) $C \cup \overline{C} = A$

Which of the following is true?

a. $B \subset C$
b. $C \subset B$
c. $A \subset C$
d. $A \subset B$
*e. $B \subset A$

Source: Silver Burdett Co., *Found. of Secondary School Math-I,*
pp. 16, 17, 18.

THE STUDENT WILL DEMONSTRATE HIS COMPREHENSION OF THE CONCEPT OF UNION OF SETS BY SOLVING PROBLEMS INVOLVING SETS DEFINED BY DESCRIPTION AND/OR SETS DEFINED BY LISTING. 0134

Let $x = \{1,2,3,4,5\}$, $y = \{1,4,5,7\}$, $z = \{2,4,5,7\}$ 0361

Which of the following is true?

a. $z \cup y = x$
*b. $y \cup x = \{7,5,1,2,4\}$
c. $y = z$
d. $z \cup y = \{1,4,5,7,2,4,5,7\}$
e. $y \subset x$

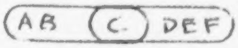
Let M be the set of all students who take instrumental music, A be those who take orchestra and B be those who take band. 0362

Which of the following is true?

a. $M \cup A = B$
b. $A \cup B = \emptyset$
c. $B \cup A = \emptyset$
*d. $A \cup B = M$
e. $M \cup B = A$

Source: Silver Burdett, Found. of Secondary School Math–Part I, pp. 14, 15, 16.

THE STUDENT CAN ILLUSTRATE HIS COMPREHENSION OF THE SYMBOLS FOR INTERSECTION AND UNION OF SETS BY SELECTING THE TRUE OR FALSE NUMBER SENTENCES ABOUT FIGURES USING THESE SYMBOLS. 0255

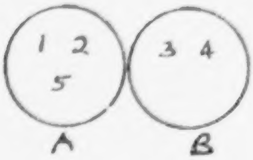


Which of the following number sentences is true about this figure? 0667

a. $\{A\ B\ C\} \cap \{D\ E\ F\} = \{A\ B\ C\ D\ E\ F\}$
b. $\{A\ B\ C\} \cup \{D\ E\ F\} = \emptyset$
c. $\{A\ B\ C\} \cup \{D\ E\ F\} = C$
*d. $\{A\ B\ C\} \cap \{D\ E\ F\} = C$
e. $\{A\ B\ C\} \cap \{D\ E\ F\} = \emptyset$

Which of the following number sentences is true about this figure? 0668

a. $A \cup B = \{0\}$
b. $A \cap B = \{1, 2, 3, 4\}$
*c. $A \cap B = \emptyset$
d. $A \cup B = \{5, 3\}$



THE STUDENT WILL INDICATE THAT HE KNOWS THE MEANING OF CARTESIAN PRODUCT OF TWO SETS BY SELECTING THE CORRECT SET OR ORDERED PAIRS FORMED BY THE CARTESIAN PRODUCT. 0120

Given the following sets: 0320

$A = \{a\}$
$B = \{1, 2, 3\}$
Which of the following is the set of orderedpairs for AXB?

a. $\{(a, 1), (a, 2), (a, 3), (a,a)\}$
b. $\{(1, a), (a, 1), (2, a), (a, 2), (3, a), (a, 3)\}$
c. $\{(1, a), (1, 2), (1, 3)\}$
*d. $\{(a, 1), (a, 2), (a, 3)\}$
e. $\{(1, a), (2, a), (3, a)\}$

Given the following sets: 0321

$A = \{a\}$
$B = \{1, 2, 3\}$
Which of the following is the set of ordered pairs for BXA?

a. $\{(a, 1), (a, 2), (a, 3), (a, a)\}$
b. $\{(1, a), (a, 1), (2, a), (a, 2), (3, a), (a, 3)\}$
c. $\{(1, a), (1, 2), (1, 3)\}$
d. $\{(a, 1), (a, 2), (a, 3)\}$
*e. $\{(1, a), (2, a), (3, a)\}$

Source: Silver-Burdett, Found. of Secondary School Math, Part I, pp. 22, 23.

THE STUDENT WILL DEMONSTRATE THAT HE KNOWS THE MEANING OF CARTESIAN PRODUCT OF TWO SETS BY SELECTING THE TWO SETS FROM WHICH A CARTESIAN PRODUCT IS FORMED. 0121

Given the following Cartesian product: 0322
C = {($, 4), (#, 4), ($, 6), (#, 8), (#, 6), ($, 8)}
Which of the following lists the complete membership of Set A and Set B from which this set of ordered pairs was formed?

a. A = {4, 6, 8} ; B = {#, $}
*b. A = {#, $} ; B = {4, 6, 8}
c. A = {#, $, %} ; B = {4, 6, 8}
d. A = {4, 6, 8, 10} ; B = {#, $}
e. A = {#, $} ; B = {4, 6, 8, 10}

Given the following Cartesian product: 0323
C = {(b, b), (c, a), (c, c), (a, b), (a, c), (a, a), (b, c),
(b, a), (c, b)}
Which of the following lists the complete membership of Set A and Set B from which this set of ordered pairs was formed?

a. A = {a, b, c}
b. A: first three letters of alphabet; B: three letters.
c. A = {a, b} ; B = {a, b, c}
*d. A = {a, b, c,} and A = B
e. A = {a, b, c} and A is equivalent to B

Source: Silver-Burdett Co., Found. of Secondary School Math.-Part I, pp. 22 and 23.

THE PUPIL WILL DEMONSTRATE HIS ABILITY TO INTERPRET THE DEFINITION OF CARTESIAN PRODUCTS BY DISTINGUISHING BETWEEN WARRANTED AND UNWARRANTED CONCLUSIONS GIVEN A SET OF DATA. 0124

Given that A x B = A x C, which conclusion is not valid? 0328

a. $A \neq \emptyset$
b. $A \cap B = A \wedge C$
c. $B = C$
*d. $B \neq C$
e. $A \cup B = A \cup C$

Given that $A = \emptyset$, and $A \times B$ and $A \times C$ are not Cartesian products, which conclusion is *not* valid? 0329

a. $B = C$
b. $B \neq C$
c. $A \times B = A \times C$
d. $\emptyset \subset A \times B$
*e. $\emptyset \not\subset A \times B$

Source: *Foundations of Secondary School Math.-Part I,* Silver-Burdett, pp. 22-23.

THE STUDENT WILL INDICATE THAT HE KNOWS THE MEANING OF ORDERED PAIRS BY SELECTING THE CORRECT ORDERED PAIR FORMED FROM THE ELEMENTS OF TWO SETS. 0119

Given the following sets: 0318

$A = \{1, 2\}$
$B = \{a, b, c, 3, 4, 5\}$
which of the following is an ordered pair formed from AXB?

a. (1, 2)
*b. (1, a)
c. (2, 2)
d. (a, 3)
e. (b, 1)

Given the following sets: 0319

$A = \{1, 2\}$
$B = \{a, b, c, 3, 4, 5\}$
which of the following is an ordered pair formed from BXA?

a. (1, 2)
b. (1, a)
c. (2, 2)
d. (a, 3)
*e. (b, 1)

Source: Silver-Burdett Co., *Found. of Secondary School Math, Part I,* pp. 22 and 23.

NUMBERS

THE STUDENT WILL EVALUATE THE DEVELOPMENT OF THE CONVENTION OF OUR NUMBER SYSTEM BY IDENTIFYING THE EVENTS WHICH HIGHLIGHT THAT DEVELOPMENT. 0180

Which civilization made the most significant contribution in the development of our number system in terms of 0522

a. clarifying what numbers a set of symbols was intended to represent.
b. simplifying the writing of numbers.
c. making calculations easier.

a. The Egyptians because they developed a simple system of counting.
b. The Babylonians because they developed a system of numeration using the idea of place value and place holder.
c. The Greeks because they invented "0" as an abbreviation for ονδεν , meaning nothing.
*d. The Hindus because they developed a definite set of symbols to be used in a place value system.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF WAYS OF RENAMING LARGE NUMBERS BY IDENTIFYING ONE BILLION AS BEING EQUAL TO ONE THOUSAND MILLION. 0060

One billion is the same amount as 0088

a. one thousand thousand
*b. one thousand million
c. one million million
d. ten thousand thousand
e. ten thousand million

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE SIZE OF ONE MILLION, BY IDENTIFYING HOW MANY TIMES LARGER IT IS THAN ONE THOUSAND. 0061

One million is how many times as large as one thousand? 0089

a. 2 times
b. 5 times
c. 10 times
d. 100 times
*e. 1000 times

THE STUDENT WILL SHOW HIS COMPREHENSION OF ROMAN NUMERALS BY REWRITING HINDU-ARABIC NUMERALS AS ROMAN AND ROMAN NUMERALS AS HINDU-ARABIC. 0145

What is Hindu-Arabic numeral that stands for X? 0403

a. 100
*b. 10,000
c. 10
d. 1,000
e. 100,000

What is the Roman numeral that stands for 50,000? 0404

a. D
b. L
c. $\overline{\mathrm{D}}$
d. $\overline{\mathrm{XXXXX}}$
*e. $\overline{\mathrm{L}}$

What is 5,946 in Roman numerals? 0405

a. MMMMMCMXXXXVI
b. $\overline{\mathrm{M}}$VCMXXXXVI
c. $\overline{\mathrm{L}}$CMXLVI
*d. $\overline{\mathrm{V}}$CMXLVI
e. $\overline{\mathrm{V}}$CMXXXXLVI

What is the Hindu-Arabic numeral for $\overline{XLV}$? 0406

a. 450
b. 6,500
*c. 45,000
d. 650,000
e. 10,055

Source: Foundations of Secondary School Math, Part I, p. 29
Silver-Burdett

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF PLACE VALUE BY IDENTIFYING HOW MANY TIMES MORE ONE DIGIT REPRESENTS THAN ANOTHER DIGIT IN THE SAME NUMBER. 0046

In the numeral 5156, the 5 on the left represents how many times as much as the 5 on the right? 0062

a. 4950
b. 1000
*c. 100
d. 10
e. none of the above

In the numeral 4,356,492 the 4 on the left represents how many times as much as the 4 on the right? 0063

a. 100
b. 1000
*c. 10,000
d. 100,000
e. none of the above

In the numeral 31.23 the 3 on the left represents how many times as much as the 3 on the right? 0064

a. 10
b. 100
*c. 1000
d. 10,000
e. none of the above

Source: S.R.A. Advancing in Mathematics, part 1.

THE STUDENT WILL SHOW HIS UNDERSTANDING OF PLACE VALUE AND THE ROLE OF ZERO AS A PLACE-HOLDER BY I DENTIFYING THE RELATIONSHIP BETWEEN NUMERALS, PLACE-VALUE NOTATION AND VALUE OF THE NUMBER REPRESENTED. 0147

Using the numerals 4, 2, 6, 9, 0 and 1 once each and also using a decimal point which of the following is the largest number that can be written? 0410

a. 096,421.
b. 964,210.
*c. 96,421.0
d. 69,421.0
e. 069,412.

In which of these numbers does the numeral 4 represent thousandths? 0411

a. 4321.
b. 4000.321
c. .0004
*d. 3.214
e. .4321

Where would you place a zero in the numeral 547.6 to represent the largest number? 0412

*a. between 7 and the decimal point
b. after the 6
c. between the decimal point and 6
d. between the 5 and the 4
e. between the 4 and the 7

Source: Foundations of Secondary School Math, Part I, pp. 29-30
Silver-Burdett.

THE STUDENT WILL SHOW HIS UNDERSTANDING OF PLACE VALUE IN THE DECIMAL SYSTEM BY TRANSLATING LARGE NUMBERS FROM WORDS TO HINDU-ARABIC NUMERALS AND FROM HINDU-ARABIC NUMERALS TO WORDS. 0148

How would you read the number 4,300,046? 0413

a. four thousand, three hundred, forty-six
b. four million, three hundred, forty-six
c. four million, thirty thousand, forty-six
d. forty three thousand, forty-six
*e. four million, three hundred thousand, forty-six

How would you write one million, two hundred seventy-five thousand, twenty-nine in standard decimal notation? 0414

a. 1,200,075,29
b. 1,275,290
*c. 1,275,029
d. 1,275,000,029
e. 12,750,029

Directions: Match the words and the numerals that name the numbers in the following list.

Five hundred thousand, sixty	d	a.	506	0415
Five hundred sixty	e	b.	566,000	0416
Five hundred sixty-six thousand	b	c.	506,000	0417
Five hundred six	a	d.	500,060	0418
		e.	560	

Which of the numerals does not match one of the names for a number? 0419

a. 1
b. 2
*c. 3
d. 4
e. 5

Source: Foundations of Secondary School Math, Part I, p. 29, Silver-Burdett.

THE STUDENT WILL SHOW HIS UNDERSTANDING OF PLACE VALUE IN THE DECIMAL SYSTEM BY TRANSLATING DECIMALS FROM WORDS TO HINDU-ARABIC NUMERALS AND FROM HINDU-ARABIC NUMERALS TO WORDS. 0149

How would you read the number 14.5024? 0420

a. fourteen and five, oh, two, four thousandths
b. fourteen and five thousand twenty-four thousands
c. fourteen and five thousand twenty-four tenths
d. fourteen and five thousand, oh, twenty-four ten thousandths
*e. fourteen and five thousand twenty-four ten thousandths

How would you write eighty-nine millionths? 0421

a. 89.000001
b. 89,000,000.
c. 0.00089
*d. 0.000089
e. 0.0000089

Directions: Match the words and the numerals that name the same numbers in the following list.

c One and thirty seven hundredths	a.	0.137	0422
a One hundred thirty seven thousandths	b.	137.	0423
e One hundred thirty seven ten thousandths	c.	1.37	0424
b One hundred thirty seven	d.	13.7	0425
	e.	0.0137	

Which of the numerals does not match one of the names for a number? 0426

a. 1
b. 2
c. 3
*d. 4
e. 5

THE STUDENT WILL SHOW HIS UNDERSTANDING OF PLACE VALUE AND THE MEANING OF TEN AS THE BASE IN THE DECIMAL SYSTEM BY TRANSLATING FROM DECIMAL TO EXPANDED NOTATION AND FROM EXPANDED NOTATION TO DECIMAL NOTATION. 0152

Which of the following correctly represents the numeral 375.1 in expanded notation? 0431

a. $3 \times 100 + 7 \times 10 + 5 + .1$
b. $3 \times (100 + 7) \times (10 + 5) \times 1 + (1 \times .1)$
*c. $(3 \times 100) + (7 \times 10) + (5 \times 1) + (1 \times .1)$
d. $(3 \times 100) + (7 \times 10) + 5 + .1$
e. $.1 + 5 + (7 \times 10) + (3 \times 100)$

Which is the decimal notation for the number whose expanded notation is $(5 \times 10{,}000) + (6 \times 1000) + (0 \times 100) + (3 \times 10) \times (4 \times 10)$? 0432

a. 5,634
b. 56,034
c. 56,134
*d. 56,070
e. 56,170

THE STUDENT CAN SIGNIFY HIS COMPREHENSION OF THE POSITIONAL SYSTEM BY CHOOSING THE CORRECT PLACE VALUE IN A GIVEN NUMERAL. 0259

In the number 6170 what is the value of 7? 0674

a. seven hundred
*b. seventy
c. seven thousand
d. seven

In the number 4,825,000 what is the value of 8? 0675

a. eight million
b. eight hundred
c. eight thousand
*d. eight hundred thousand
e. eighty thousand

In the number 20^4 what is the value of 2? 0676

*a. twenty thousand
b. two hundred thousand
c. two million

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF NUMBER VALUES BY IDENTIFYING THE LARGEST NUMBER FROM A LIST. 0012

Which of the following represents the largest number? 0015

a. $^{-}400$
b. $^{-}(3/5)$
*c. 0
d. $^{-}1$
e. $^{-}21$

Source: Insight into School Mathematics, SRA, Book 2, Chapter 2.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF THE PHRASE "SCIENTIFIC NOTATION" BY IDENTIFYING A NUMBER WHICH IS NOT WRITTEN IN SCIENTIFIC NOTATION. 0062

Which of the following is NOT written in scientific notation? 0090

a. $6000 = 6 \times 10^3$
*b. $54,000 = .54 \times 10^5$
c. $18,000,000 = 1.8 \times 10^7$
d. $45,300 = 4.53 \times 10^4$

Source: School Mathematics I, chapter 1.

THE STUDENT CAN COMPREHEND SCIENTIFIC NOTATION BY IDENTIFYING THE MEANING FOR A GIVEN NUMBER PH RASE OR A NUMBER PHRASE FOR A GIVEN MEANING. 0248

Directions: Mark the correct letter for the definition of this phrase.

In the following notation of 5^3 , 5^3 is 0651

a. the base of the notation
*b. the exponential notation
c. the exponent of the notation

Mark the correct letter for the number phrase for the negative integer exponent. 0652

a. 7^n
b. n^7
*c. n^{-7}
d. n^0

THE STUDENT CAN SHOW HIS UNDERSTANDING OF SCIENTIFIC NOTATION BY CHOOSING THE SCIENTIFIC NOTATION AMONG NON-SCIENTIFIC NOTATIONS OF THE SAME NUMBER. 0250

The number 80,000 can be written in many ways. Mark the one that is in scientific notation. 0655

a. 8 x 10,000
*b. 8×10^4
c. 80×10^3
d. $.8 \times 10^5$

Mark the correct scientific notation for .000039 0656

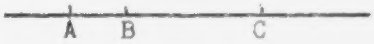
a. $.39 \times 10^{-6}$
b. 30×10^{-4}
*c. 3.9×10^{-5}
d. $.39 \times 10^{-5}$

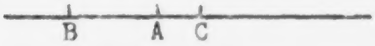
Mark the correct scientific notation for 70,800,000 0657

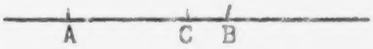
*a. 7.08×10^{7}
b. 7.08×10^{6}
c. 708×10^{5}
d. 70.8×10^{6}

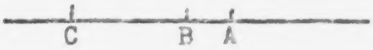
THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE CONCEPT OF ORDER IN THE SET OF WHOLE NUMBERS BY DETERMINING THE "BETWEENNESS" OF POINTS ON A NUMBER LINE. 0161

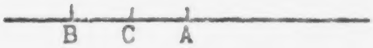
Think of a number line and three numbers, A, B, and C. Given the following relations between these three points which picture of the number line is the correct one? 0461
$C > A$
$B < A$, $A < C$ and therefore $B < C$

a.


*b.


c.


d.


e.


If on a number line, 0462
A is to the left of B
B is to the left of C
C is to the right of D
B is to the right of D
Write the points in order from smallest to largest.

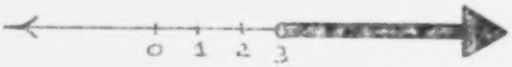
- a. ABC D
- b. BCDA
- c. CDBA
- *d. ADBC
- e. DCAB

Source: Silver-Burdett Foundations of Secondary School Math--Part I. pp. 42,43.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF NUMBER LINE GRAPHS BY IDENTIFYING THE SOLUTION SET OF A GIVEN GRAPH. 0017

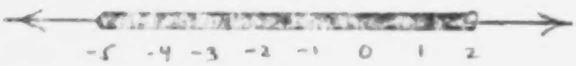
The graph represents the solution set of which of the following sentences? 0021

- a. $x < 3$
- b. $x + 3 > 0$
- *c. $x + 2 > 5$
- d. $x + 3 \geq 0$
- e. none of the above



The graph represents the solution set of which of the following sentences? 0022

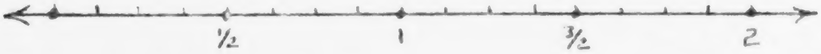
- a. $\underline{x} < 2$
- b. $^-5 < x \leq 2$
- c. $^-5 < x < 2$
- *d. $^-7 \leq x - 2 < 0$
- e. none of the above



Source: Insight into School Mathematics, SRA, Book 2, p. 213.

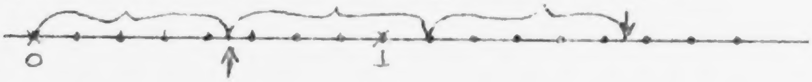
THE STUDENT WILL ANALYZE A NUMBER LINE AS EVIDENCED BY HIS ABILITY TO MATCH A NUMBER LINE ILLUSTRATION WITH A PROBLEM. 0188

The number line below can be used to explain the problem 0541



*a. 3.4 x 3/2 = n
b. 1 ÷ 1/3 = n
c. 1/3 + 1/3 = n
d. 7/8 x 3/2 = n

Identify the set of symbols which can be associated with the number line below. The symbols must be used only once and make a complete statement which the diagram will support. 0542



a. 1/2, 9/8, 27/16, 3 ÷ , x, =
*b. 1/2, 9/8, 27/16, 3 x,x, =
c. 1/2, 27/16, 3, 2, ÷ , x, =
d. 9/8, 27/16, 3, 2, ÷ , x, =

THE STUDENT WILL ANALYZE RULES FOR PRODUCTS AND SUMS OF EVEN AND ODD NUMBERS BY SELECTING APPROPRIATE RULES FROM A LIST. 0209

The product of any two odd numbers will be 0567

a. usually, but not always, odd
b. usually, but not always, even
*c. always odd
d. always even

The product of two even numbers and the product of two odd numbers 0568

a. could possibly be the same number
b. would always be the same number
*c. would never be the same number
d. would rarely, but occasionally, be the same number

The sum of any two odd numbers and the product of any two odd numbers 0569

a. would both be even numbers
b. would both be odd numbers
c. would occasionally both be either even or odd
*d. would never be both even numbers or both odd numbers

THE STUDENT CAN RECALL THE BASIC PROPERTIES OF REAL NUMBERS AND OF EQUALITY BY IDENTIFYING EITHER EXAMPLES OR PROPERTIES. 0075

Which of the sets is not closed under the operation named? 0120

a. 0, 2, 4, 6, ... , addition
b. 0, 1 , multiplication
c. 1, 3, 5, 7, multiplication
*d. 0, 1 addition
e. 0, 1, 2, 3, ... division

Which of the following illustrates the associative property of multiplication? 0121

*a. $(a \cdot b) \cdot c = a \cdot (b \cdot c)$
b. $a \cdot b = b \cdot a$
c. $a \cdot (b + c) = a \cdot b + a \cdot c$
d. $a \cdot 1 = 1 \cdot a = a$
e. none of these

Which of the following illustrates the transitive property of equality? 0122

a. If $x + 4 = 7$ then $7 = x + 4$
*b. If $2 + 1 = 3$ and $3 = 3 + 0$ then $2 + 1 = 3 + 0$
c. If $4a = 6$ and $4a = 9$ then $6 = 9$
d. If $2 + 5 = 7$ then $7 = 2 + 5$
e. none of these

Two numbers are additive inverses, if 0123

a. their product is zero
b. both are positive
c. their sum is one
*d. their sum is zero
e. they are equal

The real numbers have a unique element 0 having the property that $a + 0 = a$ and $0 \div a = 0$. This property is called the 0124

a. associative axiom of addition
b. symmetric property of equality
c. distributive axiom
d. commutative axiom of addition
*e. additive axiom of zero

Which of the following statements is true because of the additive property of equality? 0125

*a. If $x = 7$ then $x + 3 = 7 + 3$
b. If $x + 4 = 7 + 4$, then $x = 7$
c. $(x + 3) + 7 = x + (3 + 7)$
d. $x + 0 = 0 + x = x$
e. $x + y = y + x$

Use the multiplicative property of equality to complete the following conditional. If x + 4 = 12 then 0126

a. x = 8
b. x + 4 + -4 = 12 + -4
c. 4x + 16 = 6
*d. 2(x + 4) = 24
e. none of the above

Source: Dolciani, Algebra 1, Chapter 2.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF THE WORD INTEGERS BY IDENTIFYING THE CORRECT SET NOTATION FOR THE SET OF INTEGERS. 0027

The integers may be written in set form as 0037

a. (1,2,3,4,5,...)
b. (0,1,2,3,4,...)
c. (-1, -2, -3, -4, -5, ...)
d. (0, -1, -2, -3, -4, ...)
*e. (..., -2, -1, 0, 1, 2, ...)

Source: School Mathematics II, p. 35.

THE STUDENT WILL ANALYZE THE SET OF INTEGERS AS EVIDENCED BY HIS ABILITY TO SELECT FROM A LIST OF PROPERTIES OF OPERATIONS THE PROPERTY WHICH DOES NOT BELONG TO THE SET OF WHOLE NUMBERS. 0202

Select the property which belongs to the set of integers but not the set of whole numbers. 0559

a. Closure property. If a,b, and c are in the set S, then a+b is in the set S.
b. Distributive property of multiplication over subtraction. If a,b, and c are of the set S and b-c is of the set S, the ax(b-c) = (axb) - (axc).
c. Multiplication property of zero. ab is 0 if and only if at least one of a and b is 0.
*d. Additive inverse. If a is of the set S, then there exists a unique member of set S, ^{o}a, such that a + ^{o}a = 0.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF WHAT RATIONAL AND IRRATIONAL NUMBERS ARE BY IDENTIFYING AN IRRATIONAL NUMBER. 0056

Which of the following is an irrational number? 0081

a. $\frac{1}{9}$
b. 3^2
*c. 5
d. $^{-}7$
e. 1.414

Which of the following is an irrational number? 0082

a. .565656565656...
b. .418418418418...
c. .626626626626...
*d. .823847891822...
e. .1263512635126 35...

Which of the following is an irrational number? 0083

a. 64
b. 121
c. 49
*d. 145
e. all of the above

Source: School Mathematics, II, chapter 10.

THE STUDENT WILL DEMONSTRATE A BASIC KNOWLEDGE OF IRRATIONAL NUMBERS AS EVIDENCED BY HIS ABILITY TO IDENTIFY KNOWN FACTS WHICH COULD BE USED TO DEVELOP AN ARGUMENT FOR THE EXISTENCE OF IRRATIONAL NUMBERS. 0195

The Greeks discovered long ago that certain numbers could not be written as the ratio of integers. There is a proof for the existence of such numbers. This proof uses many facts but depends primarily on showing that 0552

a. the square of an even number is even.
*b. a number cannot be both even and odd.
c. the square of an odd number is odd.
d. all even whole numbers can be written as two times another whole number.

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF DIRECTED NUMBERS BY BEING ABLE TO ADD AND TO MULTIPLY DIRECTED NUMBERS. 0080

The sum of +4 + (-7 + -3) is 0135

*a. -6
b. 0
c. -8
d. + 6
e. +8

The sum of (-2 + -3) + (-4 + +6) is 0136

a. 15
b. + 5
*c. -3
d. -2
e. + 15

The Product of -3 and + 4 is 0137

a. +7
b. +1
c. +12
*d. - 12
e. -7

If $x < 0$ and $y < 0$ then 0138

a. $xy = 0$
*b. $xy > 0$
c. $xy < 0$
d. $x + y > 0$
e. none of the above

Source: Dolciani, Algebra 1, Chapter 2.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF THE PHRASE "ABSOLUTE VALUE" BY IDENTIFYING A CORRECT MEANING. 0028

The meaning of the phrase "absolute value" can be thought of as being the 0038

a. real or true amount of the number
*b. distance the number is from zero on the number line
c. opposite of a number
d. distance between the number and its opposite on the number line.

Source: School Mathematics, II, p. 60

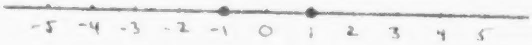
THE STUDENT CAN DEMONSTRATE AN UNDERSTANDING OF ABSOLUTE VALUE BY SOLVING EQUATIONS AND INEQUALITIES INVOLVING ABSOLUTE VALUE. 0067

If $|x| = 2$, then 0100

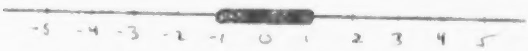
a. $x = -2$ and $x = 2$
b. $x = 2$
c. $x = -2$
*d. $x = -2$ or $x = 2$
e. none of these

Which of the following is the graph of the solution $|a| < 1$? 0101

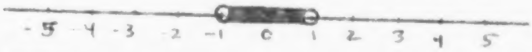
a.


-5 -4 -3 -2 -1 0 1 2 3 4 5

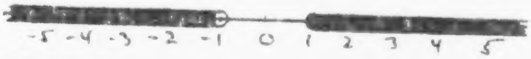
b.


-5 -4 -3 -2 -1 0 1 2 3 4 5

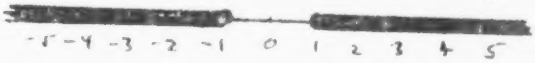
*c.


-5 -4 -3 -2 -1 0 1 2 3 4 5

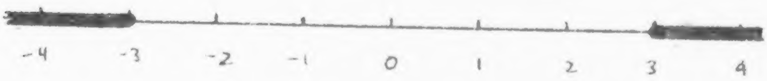
d.


-5 -4 -3 -2 -1 0 1 2 3 4 5

e.


-5 -4 -3 -2 -1 0 1 2 3 4 5

Which open sentence describes the graph shown below? 0102



a. $|a| = 3$
*b. $|a| \geq 3$
c. $|a| \leq 3$
d. $|a| = -3$ and $|a| > 3$
e. $-3 < a < 3$

In the graph of $|x - 2| \leq 5$, the distance between the graph of x and the graph of 2 is 0103

a. more than 5
b. less than 5
*c. 5 or less
d. 5 or more
e. none of the above

The solution set of the open sentence $|x - 1| > 4$ is 0104

*a. $\{x \mid x < -3 \text{ or } x > 5\}$
b. $\{x \mid x < -3 \text{ or } x < 5\}$
c. $\{x \mid x \leq -3 \text{ or } x > 5\}$
d. $\{x \mid x < 3 \text{ or } x > 5\}$
e. $\{x \mid x > -3 \text{ or } x < 5\}$

The solution set of the open sentence $|n| + 4 = 2$ is 0105

a. $\{-2\}$
b. $\{2\}$
c. $\{0\}$
*d. $\emptyset$

Source: Dolciani - Algebra 1, Chapter 1 and Chapter 4.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF THE PHRASE "PRIME NUMBER" BY CHOOSING THE CORRECT MEANING FROM A LIST. 0031

The meaning of the phrase "prime number" can be stated. A prime number is a number that 0045

a. has more than two factors
b. is not divisible by 2
*c. has two and only two factors
d. is odd and has less than two factors.

Source: School Mathematics II, p. 103.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF TWIN PRIMES BY IDENTIFYING A PAIR OF TWIN PRIMES. 0032

Which of the following is an example of twin primes? 0046

a. 2, 3
*b. 5, 7
c. 13, 13
d. 9, 11

Source: School Mathematics, II, p. 108.

THE STUDENT CAN DEMONSTRATE UNDERSTANDING PRIME AND COMPOSITE NUMBERS BY FACTORING COMPOSITE NUMBERS. 0093

The number _________ is a prime number. 0188

a. 0
b. 1
*c. 2
d. 4

A prime number has exactly _______ different factors. 0189

a. 0
b. 1
*c. 2
d. 3

________ even number(s) is (are) prime. 0190

a. No
*b. One
c. Two
d. Many

Composite numbers may be divisible by _______. 0191

a. other composite numbers.
b. prime numbers.
c. two.
*d. all of the above.

There are _____ prime numbers between 1 and 20. 0192

a. 9
*b. 8
c. 7
d. 6

Fifteen is divisible by ______ different primes. 0193

a. one
*b. two
c. three
d. four

Natural numbers that contain more than two different factors are ______ numbers. 0194

a. prime
b. odd
c. even
*d. composite

If a number has a prime number of divisors then the number is __________. 0195

a. prime
b. composite
c. odd
*d. prime or power of a prime

A number is completely factored if it is expressed as the product of ________ numbers. 0196

a. several
b. two
c. other
*d. prime

2 • 3 • 5 . 7 is the complete factorization of _______. 0197

a. 180
b. 140
*c. 210
d. 240

The complete factorization of 625 is _______. 0198

a. 1 x 5 x 5 x 5 x 5
b. 5 x 5 x 25
*c. 5^4
d. 5 x 125

THE STUDENT WILL USE HIS KNOWLEDGE OF PRIMES TO EXPRESS A NUMBER AS THE PRODUCT OF ONE AND ONLY ONE SET OF PRIMES BY SELECTING FROM FOUR SETS THE SET WHICH REPRESENTS A UNIQUE FACTORIZATION. 0191

299 can be expressed as the product of 0545

a. 11,27,2
b. 7,42,5
*c. 23,13
d. 1,299

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF THE PHRASE "RELATIVELY PRIME" BY SELECTING A PAIR OF NUMBERS WHICH ARE RELATIVELY PRIME. 0033

Which of the following pairs of numbers are relatively prime? 0047

a. 15, 24
b. 14, 16
c. 9, 27
d. 13, 26
*e. 8, 25

Source: School Mathematics II, p. 110.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE PURPOSE OF THE SIEVE OF ERATOSTHENES BY SELECTING ITS CORRECT PURPOSE. 0042

The Sieve of Eratosthenes is a tool for finding: 0056

- *a. prime numbers
- b. the Greatest Common Factor
- c. the Least Common Multiple
- d. square and triangular numbers
- e. the divisibility of a number

Source: School Mathematics II, p. 105.

THE STUDENT WILL BE ABLE TO APPLY THE PROPERTIES OF REAL NUMBERS OR OF EQUALITY BY JUSTIFYING STEPS IN A PROOF. 0081

Which property of real numbers or of equality enables you to go from Step 1 to Step 2? 0139

Step 1: $b + c + (-c) = b$

Step 2: $b + [c + (-c)] = b$

- a. Transitive Property of Equality
- b. Additive Property of Equality
- c. Axiom of Additive Inverses
- *d. Associative axiom of addition
- e. Axiom of closure for Addition

Which property of real numbers or of equality enables you to go from Step 2 to Step 3? 0140

Step 2: $b + [c + (-c)] = b$

Step 3: $b = b + [c + (-c)]$

- a. transitive property of equality
- *b. symmetric property of equality
- c. additive property of equality
- d. axiom of additive inverses
- e. additive axiom of zero

Source: Dolciani, Algebra 1, Chapter 2.

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF NATURAL NUMBER PROPERTIES BY CHOOSING THE CORRECT PROPERTY OF NATURAL NUMBERS IN PROBLEMS DEALING WITH EXPRESSIONS. 0104

Directions: Choose the letter of the property or properties that take you from the first expression to the equivalent second expression.

35 + (89 + 92)   (35 + 92) + 89   0280

- a. Commutative
- b. Associative
- c. Distributive
- *d. a and b
- e. a and c

15 (2 • 9)   (2 • 9) 15   0281

- *a. Commutative
- b. Associative
- c. Distributive
- d. Identity
- e. a and b

5 (8 + 13)   8 (5) + 13 (5)   0282

- a. Commutative
- b. Associative
- c. Distributive
- *d. a and c
- e. a and b

19 + (3•5)   (5•3) + 19   0283

- *a. Commutative
- b. Associative
- c. Distributive
- d. Identity
- e. a and b

$2(22 + 33)$ $(33 + 22)2$ 0284

*a. Commutative
b. Associative
c. Distributive
d. Closure
e. Identity

If $a \in M$, and $b \in M$, then $(A+b) \in M$. 0285

a. Commutative
b. Associative
c. Addition
*d. Closure
e. Identity

$5(1 + 0)$ $5(1)$ 0286

a. Commutative
b. Associative
c. Distributive
*d. Identity
e. c and d

$9(7) + 9(8)$ $9(15)$ 0287

a. Commutative
b. Associative
c. Distributive
d. Addition
*e. c and d

$a \cdot b + c$ $c + b \cdot a$ 0288

*a. Commutative
b. Associative
c. Distributive
d. a and b
e. a and c

$x(y + z)$ $xy + xz$ 0289

a. Commutative
b. Associative
*c. Distributive
d. a and c
e. b and c

Source: Seeing Through Mathematics, Van Engen, etal, Book I, p. 273.

THE STUDENT WILL RECALL HIS KNOWLEDGE OF THE DISTRIBUTIVE PROPERTY FOR WHOLE NUMBERS BY FINDING THE CORRECT REPLACEMENT FOR THE VARIABLE IN NUMBER SENTENCES USING THE DISTRIBUTIVE PROPERTY. 0138

$4 \times 12 = 4 \times (3+n) = (4 \times 3) + (4 \times n) = 48$ 0369
What is the replacement for n that will make the sentence true?

a. 4
*b. 9
c. 3
d. 10
e. 12

$65 = (5 \times 3) + (5 \times n) = 5(3 + n) = 5 \times 13$ 0370
What is the replacement for n that will make the sen tence true?

a. 5
b. 7
c. 13
d. 12
*e. 10

Source: Found. of Secondary School Math--Part I, Silver-Burdett, pp. 24-26.

THE STUDENT WILL USE HIS UNDERSTANDING OF EQUALITY TO DETERMINE IF OTHER RELATIONS POSSESS THE PROPERTIES OF SYMMETRY, REFLEXIVITY, AND TRANSITIVITY. 0166

Directions: Three of the properties of relations are reflexive, symmetric and transitive. For each of the following sentences, mark your answers as follows:

a. reflexive only
b. symmetric only
c. reflexive and symmetric
d. transitive only
e. reflexive, symmetric and transitive

A is a cousin of B b 0489

$8 > 4$ d 0490

$15 + 2 = 17$ e 0491

Set x is equivalent to Set y e 0492

Let A, B and C represent sets. Which of the following statements are true? 0493

I. $A \subset A$
II. If $A \subset B$, $B \subset A$
III. If $A \subset B$ and $B \subset C$, then $A \subset C$.
IV. The subset relation between sets is reflexive, symmetric and transitive
V. The subset relation between sets is neither reflexive, not symmetric nor transitive.

a. I, II, and III
b. I, II, III and IV
c. I, III, and IV
d. V only
*e. I and III only

Source: Silver-Burdett, Found. of Secondary School Math—Part I, pp. 45, 46.

THE STUDENT CAN ANALYZE THE REASONS FOR 0 AND 1 HAVING THE PROPERTY OF IDENTITY AND CHOOSE THE CORRECT REASON. 0252

Why is 0 the Property of Identity for addition and subtraction? 0661
Analyze the following reasons and complete the phrase. "0 added to or subtracted from a number"

a. does not change the original number.
*b. names the original number.
c. identifies the 0.
d. changes the number.

Why is 1 the Property of Identity for multiplication and division? 0662
Analyze the following reasons and complete the phrase. "1 multiplied to or divided into a number"

a. does not change the original number
*b. names the original number
c. identifies the 1
d. changes the number

THE STUDENT WILL ANALYZE A PROOF OF THE COMMON ALGORITHMS BY MATCHING EACH STEP OF THE PROOF WITH THE PROPERTY IT REPRESENTS. 0184

From the list of properties below select the one which belongs with each step of the proofs below.

A. Distributive property
B. Associative property
C. Commutative property
D. Identity element
E. Basic facts

$(4 + 4) + 4 = [(4 \times 1) + (4 \times 1)] + 4$	A	B	C	*D	E	0527
$(4 + 4) + 4 = [4 \times (1 + 1)] + 4$	*A	B	C	D	E	0528
$(4 + 4) + 4 = (4 \times 2) + 4$	A	B	C	D	*E	0529
$(4 + 4) + 4 = (4 \times 2) + (4 \times 1)$	A	B	C	*D	E	0530
$(4 + 4) + 4 = 4 \times (2 + 1)$	*A	B	C	D	E	0531
$(4 + 4) + 4 = 4 \times 3$	A	B	C	D	*E	0532
$(4 + 4) + 4 = 3 \times 4$	A	B	*C	D	E	0533

(The questions below constitute a proof that $6 \times 28 = 168$.)

1st step: $6 \times 28 = 6[(2 \times 10) + 8 \times 1)]$

$6 \times 28 = [6 \times (2 \times 10)] + [6 \times (8 \times 1)]$ *A B C D E 0534

$6 \times 28 = [(6 \times 2) \times 10] + [(6 \times 8) \times 1]$ A *B C D E 0535

$6 \times 28 = (12 \times 10) + 48 \times 1)$ A B C D *E 0536

$6 \times 28 = 120 + 48$ A B C D *E 0537

Last step: $6 \times 28 = 168$

THE STUDENT WILL ANALYZE A SET OF PROPOSITIONS ABOUT A SET OF NUMBERS BY SELECTING A PROPOSITION WHICH IS A COMPLETE STATEMENT ABOUT THE SET. 0190

1. 1
2. 3,5
3. 7,9,11
4. 13,15,17,19
5. 21,23,25,27,29

Given the triangular arrangement of odd numbers above which statement below is true for the array if extended. 0544

- a. The sum of the first N odd numbers is the square of N.
- b. the sum of any number of odd numbers is the cube of a number.
- *c. the sum of any line of even numbers belonging to the array above is the number of elements to the third power.
- d. the sum of the first N number of lines in the array above is the same as the sum of the first N odd numbers.

THE STUDENT WILL ANALYZE AN ILLUSTRATIVE EXAMPLE OF THE REASONABLENESS OF A FAMILIAR ALOGRITHM BY SELECTING THE DEMONSTRATION WHICH IS 0192

1. COMPLETE (NO STEPS OMITTED).
2. ORDERED (LOGICALLY DEVELOPED).
3. CONSISTENT WITH PROPERTIES OF WHOLE NUMBERS, AND THE NUMERATION SYSTEM.

Directions: Select the illustrative example of the familiar alogorithms which is:

1. complete (no steps omitted)
2. ordered (logically developed)
3. consistent with properties of whole numbers and the numeration system.

a. 1) 33 + 45 = [(3 x 10) + (3 x 1)] + [(4 x 10) + (5 x 1)] 0546
2) [(3 x 10) + (3 x 1)] + [(5 x 1) + (4 x 10)]
3) [(3 x 10) + (3 x 1)] + (5 x 1) + (4 x 10)
4) (4 x 10) + (3 x 10) + (3 x 1) + (5 x 1)]
5) [(4 x 10) + (3 x 10)] + [(3 x 1) + (5 x 1)]
6) [(4 + 3) x 10] + [(3 + 5) x 1]
7) (7 x 10) + (8 x 1)
8) 78

*b. 1) 98-32 = [(9 x 10) + (8 x 1)] - [(3 x 10) + (2 x 1)]
2) [(9 x 10) - (3 x 10)] + [(8 x 1) - (2 x 1)]
3) [(9 -3) x 10] + [(8 - 2) x 1]
4) (6 x 10) + (6 x 1)
5) 66

c. 1) 6 x 39 = 6 x [(3 x 10) + (9 x 1)]
2) [6 x (3 x 10)] + [6 x (9 x 1)]
3) [(6 x 3) x 10] + [(54 x 1)]
4) (18 x 10) + (54 x 1)
5) 180 + 54
6) 234

d. 1) 4386 - 32 =
2) = 4387 = (32 x 100) + 1187
3) (32 x 100) + [(32 x 30) + 227]
4) [(32 x 100) + (32 x 30)] + 227
5) (32 x 130) + 227
6) (32 x 130) + [(32 x 7) + 3]
7) [(32 x 130) + (32 x 7)] + 3
8) [32 x (130 + 7)] + 3
9) (32 x 137) + 3

THE STUDENT WILL SHOW KNOWLEDGE OF GREATEST COMMON FACTOR AND LEAST COMMON MULTIPLE BY FINDING THE GCF AND LCM FOR GIVEN NUMBERS. 0094

The least common multiple of 6 and 7 is ________. 0199

a. 1
b. 2
*c. 42
d. 13
e. none of the above

The least common multiple of two numbers must be at least as great as ________. 0200

*a. the greater of the two numbers.
b. the lesser of the two numbers.
c. the product of the two numbers.
d. none of the above.
e. both a and c are correct.

The least common multiple of 24 and 84 is 0201

a. $2^2 \times 3^1 \times 7$
b. $2^3 \times 3^2 \times 7$
c. $2^1 \times 3^1 \times 7^1$
*d. $2^3 \times 3^1 \times 7^1$
e. none of the above

The greatest common factor of 12 and 36 is ________. 0202

a. 2^2
b. 3^1
*c. $2^2 \times 3^1$
d. $2^2 \times 3^3$
e. none of the above

The greatest common factor of 2 numbers must be no greater than the ________. 0203

a. greater of the two numbers.
*b. lesser of the two numbers.
c. product of the two numbers.
d. both a and c
e. none of the above

The lowest common denominator for finding the sum of 1/15 and 1/72 is ________. 0204

a. $2^3 \times 3^2 \times 5$

b. 72×15

c. $2 \times 3 \times 5$

d. $2^3 \times 3^2 \times 5^1$

*e. both a and d

THE STUDENT WILL EVALUATE A SYSTEM OF NUMERATION BY IDENTIFYING THE ADVANTAGES AND DISADVANTAGES WHICH WOULD ARISE FROM ITS USE. 0175

The system of numeration which uses only the symbols below: 0517

Number	Symbol
1	1
10	∩
100	𓍢
1000	𓆼
1,000,000	𓁨

where

7 = |||||||
50 = ∩∩∩∩∩
234 = 𓍢𓍢∩∩∩||||

a. is difficult to use because too many different symbols are needed.
b. is easy to work with because it uses place value.
*c.. is difficult to use for representing large numbers.
d. has the same advantage as our number system because it is based on ten.

THE STUDENT WILL ANALYZE SOME NUMERICAL RELATIONSHIPS AND SELECT ANSWERS FROM LISTS WHICH GIVE SOLUTIONS TO QUESTIONS INVOLVING THE RELATIONSHIPS GIVEN. 0234

Directions: Illustrated below is a new relationship and what happens when you put certain numbers in the correct places. Find the relationship, then answer the items below.

Examples:

3	2	6
4 = 19	1 = 15	7 = 37
5	7	5

In what base must the numbers be for the relationship you discovered to work? 0622

a. 2
b. 8
c. 9
*d. 10
e. 12

6
6 =
5 0623

a. 19
b. 66
c. 30
*d. 36
e. 33

12
3 =
1 0624

a. 12
b. 9
*c. 15
d. 37
e. 36

1 0625
1 =
1

a. 1
b. 0
*c. 2
d. 3
e. 11

4 0626
4 =
4

a. 8
b. 12
c. 16
*d. 20
e. 24

ARITHMETIC OPERATIONS

THE STUDENT WILL EVALUATE THE RESULTS OF CERTAIN DISCOVERIES IN MATHEMATICS BY IDENTIFYING THE MOST IMPORTANT OUTCOME, IN TERMS OF THE DEVELOPMENT OF MATHEMATICS, OF THAT DISCOVERY. 0194

The discovery of irrational numbers was important in the history of mathematics because 0551

a. a length was discovered which did not have an acceptable number to go with it.
b. portions of mathematics involving arithmetic calculations were neglected for centuries.
*c. arithmetic was proven incomplete.
d. the Greeks turned their attention to geometry.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF COMPUTATIONS IN THE ROMAN SYSTEM OF NUMERATION BY FINDING SUM, ADDENDS AND DIFFERENCES IN THIS SYSTEM. 0144

Express this sum in simplest Roman numerals. XLVII + CLXVI 0399

a. CLXXXIII
b. CCXVVIII
c. CCXXIII
d. CLXVVIII
*e. CCXXXIII

What are two addends in Roman numerals whose sum is CLXIV? 0400

a. CIX + XI
*b. XCII + LXXII
c. CV + LXI
d. XI + CLV
e. CLXII + XII

Express the following differences in simplest Roman numerals. 0401
MCDXCII - DLXXXVIII

- a. MCLXXVI
- b. MCDLIV
- *c. CMIV
- d. CMDLIV
- e. MCDLIV

What is the addend to which you would add MCCXXI to get a sum of MCCCXXXVIII? 0402

- a. MDXCIII
- b. MXCIII
- c. DXCIII
- *d. DXVII
- e. DXCVIII

Source: Foundations of Secondary School Math, Part I, Silver-Burdett, p. 29.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF ROMAN NUMERALS IN A WORD PROBLEM WHERE BOTH TRANSLATION AND COMPUTATION ARE INVOLVED AND SELECT THE CORRECT ANSWER TO A QUESTION. 0146

A certain school was built in 1958, a church in MCMXXXIV, and a branch post office in MCMXLIX.

Which of the three buildings is the oldest? 0407

- a. school
- *b. church
- c. post office
- d. church and post office and both are the same age
- e. school and post office and both are the same age

What is the difference in age between the two newer buildings? 0408

- a. IX years
- b. XIV years
- c. same age
- *d. XI years
- e. XVI years

Rome was first settled around DCCLII B.C. One of the best known of ancient buildings in Rome is the large, half-ruined Colosseum, built around LXXV A.D. About how many years after Rome was first settled was the Colosseum built? 0409

a. DCLXXVIII
b. DCCXXVII
*c. DCCCXXVIII
d. DCCLLXXVII
e. DCCCXXVII

Source: Foundations of Secondary School Math, Part I, p. 29.
Silver-Burdett

GIVEN A DEFINITION OF A NEW TERM THE STUDENT WILL APPLY WHAT HE KNOWS ABOUT THE PRINCIPLES OF ARITHMETIC TO THE DERIVATION OF SOLUTIONS WHICH THE TERM IDENTIFIES AS EVIDENCED BY HIS ABILITY TO SELECT A SOLUTION WHICH FITS THE DEFINITION. 0193

A perfect number is a number equal to the sum of all its factors including one but excluding itself. Which number below is a perfect number. 0550

a. 8
*b. 28
c. 39
d. 101

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE MEANING OF CLOSURE FOR A NUMBER SYSTEM UNDER AN OPERATION BY DECIDING WHETHER OR NOT A SET OF NUMBERS IS CLOSED UNDER A REAL OR A FICTICIOUS OPERATION. 0130

Given the following sets and an operation for each. Which sets are closed with respect to the operation given? 0351

1) $A = \{1,3,5\}$ for multiplication
2) $B = \{1,3,5\}$ for addition
3) $C = \{\text{odd numbers}\}$ for multiplication
4) $D = \{\text{odd numbers}\}$ for addition

a. 1 only
*b. 3 only
c. 2 and 4
d. 1 and 3
e. 1,2,3, and 4

The operation star,*, is defined as $3*5 = 16$. To star means to add the numbers and then double the answer. Which of the following sets are closed with respect to star? 0352

1) the set of whole numbers
2) $A = \{1,3,5\}$
3) $C = \{\text{odd numbers}\}$

*a. 1 only
b. 3 only
c. 1 and 2
d. 2 and 3
e. 1 and 3

Source: Foundations of Secondary School Math, Part I, Silver-Burdett, Chapter 1.

THE STUDENT WILL BE ABLE TO RECALL THE GENERAL FORMS OF THE ADDITIVE PROPERTY OF ZERO BY IDENTIFYING AN INCORRECT FORM FROM A LIST. 0006

Assuming n 0, which equation does NOT illustrate that zero is the identity element for addition? 0008

a. $n + 0 = n$
b. $0 + n = n$
c. $n = 0 + n$
d. $n = n + 0$
*e. $0 = n + 0$

Source: Insight into School Mathematics, SRA, Book 2, p. 54.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE PROPERTIES FOR ADDITION OF WHOLE NUMBERS BY IDENTIFYING THE NUMBER SENTENCE WHICH ILLUSTRATES A GIVEN PROPERTY. 0128

Which of the number sentences below illustrates the closure property for addition of whole numbers? 0341

a. $7 + 0 = 7$
b. $(a + b) + (6 + 3) = (6 + 3) + (a + b)$
*c. $(9 + 3) + 4 = 16$
d. $(8 + 1) + (2 + 6) = 8 + (1 + 2) + 6$
e. $(4 + a) + (b + 9) = (4 + 9) + (a + b)$

Which of the number sentences below illustrates the identity element for addition of whole numbers? 0342

*a. $7 + 0 = 7$
b. $(a + b) + (6 + 3) = (6 + 3) + (a + b)$
c. $(9 + 3) + 4 = 16$
d. $(8 + 1) + (2 + 6) = 8 + 1 (1 + 2) + 6$
e. $(4 + a) + (b + 9) = (4 + 9) + (a + b)$

Which of the number sentences below illustrates the associative property for addition of whole numbers? 0343

a. $7 + 0 = 7$
b. $(a + b) + (6 + 3) = 6 + 3) + (a + b)$
c. $(9 + 3) + 4 = 16$
*d. $(8 + 1) + (2 + 6) = 8 + (1 + 2) + 6$
e. $(4 + a) + (b + 9) = (4 + 9) + (a + b)$

Which of the number sentences below illustrates the commutative property for the addition of whole numbers? 0344

a. $7 + 0 = 7$
*b. $(a + b) + (6 + 3) = (6 + 3) + (a + b)$
c. $(9 + 3) + 4 = 16$
d. $(8 + 1) + (2 + 6) = 8 + (1 + 2) + 6$
e. $(4 + a) + (b + 9) = (4 + 9) + (a + b)$

Which of the number sentences below illustrates the commutative and associative properties for the addition of whole numbers? 0345

a. $7 + 0 = 7$
b. $(a + b) + (6 + 3) = (6 + 3) + (a + b)$
b. $(a + b) + (6 + 3) = (6 + 3) + (a + b)$
c. $(9 + 3) + 4 = 16$
d. $(8 + 1) + (2 + 6) = 8 + (1 + 2) + 6$
*e. $(4 + a) + (b + 9) = (4 + 9) + (a + b)$

Source: Foundations of Secondary School Math, Part I, Silver-Burdett, pp. 24-26.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE PROPERTIES FOR ADDITION OF WHOLE NUMBERS BY IDENTIFYING THE PROPERTY ILLUSTRATED BY A NUMBER SENTENCE. 0129

Which of the properties for addition of whole numbers is illustrated by: $3 + (4 + 7) = 3 + (7 + 4)$? 0346

*a. commutative
b. associative
c. commutative and associative
d. identity element
e. closure

Which of the properties for addition of whole numbers is illustrated by: $8 + 2 = 10$ 0347

a. commutative
b. associative
c. commutative and associative
d. identity element
*e. closure

Which of the properties for addition of whole numbers is illustrated by: $(2 + 3) + (4 + 5) + 6 = (2 + 4) + 3 + (5 + 6)$? 0348

a. commutative
b. associative
*c. commutative and associative
d. identity element
e. closure

Which of the properties for addition of whole numbers is illustrated by: $b + 0 = b$? 0349

a. commutative
b. associative
c. commutative and associative
*d. identity element
e. closure

Which of the properties of addition of whole numbers is illustrated by: $a + (b + c) + d = (a + b) + (c + d)$? 0350

a. commutative
*b. associative
c. commutative and associative
d. identity element
e. closure

Source: Foundations of Secondary School Math, Part I, Silver-Burdett, pp. 24-26.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE FACT THAT SUBTRACTION IS NOT ASSOCIATIVE BY IDENTIFYING A MATHEMATICAL SENTENCE AS ONE WHICH ILLUSTRATES THAT FACT. 0064

The sentence $a - (b - c) \neq (a - b) - c$ can be interpreted to mean 0095

a. subtraction is not commutative
b. subtraction is not distributive
*c. subtraction is not associative
d. subtraction is commutative but not associative
e. subtraction is associative but not commutative

Source: School Mathematics I, chapter 2.

THE STUDENT WILL BE ABLE TO RECALL THE GENERAL FORMS OF THE MULTIPLICATIVE PROPERTY OF ZERO BY IDENTIFYING AN INCORRECT FORM FROM A LIST. 0005

Assuming $n \neq 0$, which equation does NOT illustrate the multiplicative property of zero? 0007

a. $0 \cdot n = 0$
b. $n \cdot 0 = 0$
c. $0 = n \cdot n$
*d. $n = 0 \cdot n$
e. $0 = 0 \cdot n$

Source: Insight into School Mathematics, SRA, Book 2, p. 70.

THE STUDENT WILL RECALL THE DIFFERENT WAYS TO DESIGNATE MULTIPLICATION BY DETERMINING WHICH OF SEVERAL MULTIPLICATION ALGORITHMS ARE CORRECT. 0125

Which of the following is a correct way to notate the operation of multiplication? 0330

1) $7 \times 8 = 56$
2) $7 \cdot 8 = 56$
3) $7y = 56$
4) $7(y + 6) = 56$
5) $xy = 56$

a. 1 only
b. 1 and 2
c. 1, 2, and 3
d. 1, 2, 3, and 4
*e. 1, 2, 3, 4, and 5

Source: Foundations of Secondary School Math, Part I, Silver-Burdett p. 25.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE PROPERTIES FOR MULTIPLICATION OF WHOLE NUMBERS BY IDENTIFYING THE NUMBER SENTENCE WHICH ILLUSTRATES A GIVEN PROPERTY. 0126

Which of the number sentences below illustrates the commutative property for the multiplication of whole numbers? 0331

a. $0 = a \times (6 \times 0) \times b$
*b. $a \times 8 = 8a$
c. $(9 \times 3) \times a = 27a$
d. $15 = (3 \times 1) \times (5 \times 1)$
e. $(a \times 7) \times 3 = a \times (7 \times 3)$

Which of the number sentences below illustrates the associative property for the multiplication of whole numbers? 0332

a. $0 = a \times (6 \times 0) \times b$
b. $a \times 8 = 8a$
c. $(9 \times 3) \times a = 27a$
d. $15 = (3 \times 1) \times (5 \times 1)$
*e. $(a \times 7) \times 3 = a \times (7 \times 3)$

Which of the number sentences below illustrates the closure property for the multiplication of whole numbers? 0333

a. $0 = a \times (6 \times 0) \times b$
b. $a \times 8 = 8a$
*c. $(9 \times 3) \times a = 27a$
d. $15 = (3 \times 1) \times (5 \times 1)$
e. $(a \times 7) \times 3 = a \times (7 \times 3)$

Which of the number sentences below illustrates the multiplication property of zero with whole numbers? 0334

*a. $0 = a \times (6 \times 0) \times b$
b. $a \times 8 = 8a$
c. $(9 \times 3) \times a = 27a$
d. $15 = (3 \times 1) \times (5 \times 1)$
e. $(a \times 7) \times 3 = a \times (7 \times 3)$

Which of the number sentences below illustrates the identity element for the multiplication of whole numbers? 0335

a. $0 = a \times (6 \times 0) \times b$
b. $a \times 8 = 8a$
c. $(9 \times 3) \times a = 27a$
*d. $15 = (3 \times 1) \times (5 \times 1)$
e. $(a \times 7) \times 3 = a \times (7 \times 3)$

Source: Foundations of Secondary School Math, Part I, Silver-Burdett, pp. 24-26.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE PROPERTIES FOR MULTIPLICATION OF WHOLE NUMBERS BY IDENTIFYING THE PROPERTY ILLUSTRATED BY A NUMBER SENTENCE. 0127

Directions: In each of the questions below indicate the property of multiplication of whole numbers that is illustrated by

a. identity element
b. associative
c. closure
d. multiplication property of zero
e. commutative

_b_ Which of the properties for multiplication of whole numbers is illustrated by: $21 \times 8 = 3 \times 56$? 0336

_d_ Which of the properties for multiplication of whole numbers is illustrated by: $(6 \times 4) \times (0 \times b) = 0$? 0337

_c_ Which of the properties for multiplication of whole numbers is illustrated by: $(3 \times 2) \times 5 = 30$? 0338

_e_ Which of the properties for multiplication of whole numbers is illustrated by: $(4 \times 7) \times 2 = (7 \times 4) \times 2$? 0339

_a_ Which of the properties for multiplication of whole numbers is illustrated by: $(5 \times 8) \times 1 = 5 \times 8$? 0340

Source: Foundations of Secondary School Math, Part I, Silver-Burdett, pp. 24-26.

THE STUDENT WILL DEMONSTRATE HIS ABILITY TO CHOOSE A WARRANTED CONCLUSION BY INDICATING THE VALID CONCLUSION TO BE DERIVED FROM DATA CONCERNING THE ROLE OF ZERO IN MULTIPLICATION. 0165

Given a and b are whole numbers and ab = 0, which of the following conclusions are valid? 0487

I. a is zero
II. b is zero
III. a and b are both zero
IV. neither a nor b is zero
V. either a or b is zero

*a. I, II, III, and V
b. III and V only
c. IV only
d. V only
e. I, III, IV, and V

Suppose two students both choose a whole number. What can you say about the numbers if their product is zero. 0488

a. The first student chose zero.
b. Both students chose zero
c. Neither student chose zero.
*d. At least one student chose zero.
e. The second student chose zero.

Source: Silver-Burdett, Found. of Secondary School Math— Part I, pp. 45-48.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE PROPERTIES OF MULTIPLICATION BY JUSTIFYING EACH STATEMENT IN A PROOF. 0168

Directions: Given the properties of multiplication of whole numbers:
a. Commutative
b. Associative
c. Distributive
d. 1 is the Identity Element
e. Closure

What is the reason for each step of the proof below that $(7 \times n) \times 8 = 56 \times n$?

$(7 \times n) \times 8 = 7 \times (n \times 8)$ b 0496

$(7 \times n) \times 8 = 7 \times (8 \times n)$ a 0497

$(7 \times n) \times 8 = (7 \times 8) \times n$ b 0498

$(7 \times n) \times 8 = 56 \times n$ d 0499

Directions: Given the following properties for addition and multiplication of whole numbers:

a. Closure of whole numbers under addition
b. Closure of whole numbers under multiplication
c. Renaming of numerals
d. Distributive property
e. Multiplication of whole numbers is commutative

What is the reason for each step below in proving that $64 \times 75 = 4800$?

$64 \times 75 = (60 + 4) \times 75$ c 0500

$64 \times 75 = (60 \times 75) + (4 \times 75)$ d 0501

$64 \times 75 = 60 \times (70 + 5) + 4 \times (70 + 5)$ c 0502

$64 \times 75 = (60 \times 70) + (60 \times 5) + (4 \times 70) + (4 \times 5)$ d 0503

$64 \times 75 = 4200 + 300 + 280 + 20$ b 0504

$64 \times 75 = 4800$ a 0505

Source: Silver-Burdett: Foundations of Secondary School Math--Part I. pp. 45-48.

THE STUDENT CAN ANALYZE THE ASSOCIATIVE DISTRIBUTIVE PROPERTY OF MULTIPLICATION BY SELECTING THE REASONS FOR DOING IT. 0260

Using the associative property of addition, the following problem "X" can be written as y. 0677

x) $7 \times 2^2 \times 5^2 = 7 \times (2 \times 2) \times (5 \times 5)$
$= (7 \times 4) \quad \times 25$
$= 28 \times 25 = 700$

y) $7 \times 2^2 \times 5^2 = 7 \times (2 \times 2) \times (5 \times 5)$
$7 \times (2 \times 5) \times (2 \times 5)$
$7 \times (10 \times 10)$
7×100
700

Mark the reason in changing or not changing it which most simplifies computations.

*a. The arithmetic is easier because multiples of 100 are easier to work with.
b. The arithmetic is harder because it involves another step.
c. The arithmetic in y is busy work.
d. Using exponents shows your understanding of powers.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE FACT THAT ONE CANNOT DIVIDE BY ZERO BY INDICATING THAT A PROBLEM INVOLVING DIVISION BY ZERO CANNOT BE DONE. 0004

What is the correct value of n in the equation $4 \div 0 = n$? 0006

a. 0
*b. cannot be done
c. 1
d. 4
e. an infinite number of solutions

Source: Insight into School Mathematics, Book 2, SRA, p. 42.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 3 BY SELECTING A NUMBER WHICH IS NOT DIVISIBLE BY 3. 0034

Which of the following is NOT divisible by 3? 0048

a. 323,796,411
b. 592,766,484
*c. 777,492,733
d. 813,576,045

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 4 BY SELECTING A NUMBER WHICH IS NOT DIVISIBLE BY 4. 0035

Which of the following is NOT divisible by 4?

a. 465,862,964 0049
b. 731,555,736
*c. 222,222,422
d. 888,675,388

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 6 BY SELECTING A NUMBER WHICH IS NOT DIVISIBLE BY 6. 0036

Which of the following is NOT divisible by 6? 0050

a. 972,656,844
b. 732,369,420
c. 538,167,702
*d. 477,972,734

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 9 BY SELECTING A NUMBER WHICH IS NOT DIVISIBLE BY 9. 0037

Which of the following is NOT divisible by 9? 0051

*a. 524,357,629
b. 692,231,427
c. 446,532,633
d. 123,456,789

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 3 BY SELECTING THE DIGIT(S) WHICH CAN BE USED IN THE ONES PLACE OF AN UNFINISHED NUMBER TO MAKE THE NUMBER DIVISIBLE BY 3. 0038

Which of the following can be used in the ones place of 652_ to make the completed number divisible by 3? 0052

a. 3, 6, 9
*b. 2, 5, 8
c. 3
d. 0, 3, 6, 9

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 4 BY SELECTING THE DIGIT(S) WHICH CAN BE USED IN THE ONES PLACE OF AN UNFINISHED NUMBER TO MAKE THE NUMBER DIVISIBLE BY 4. 0039

Which of the following can be used in the ones place of 42,54_ to make the completed number divisible by 4? 0053

a. 1, 5, 9
b. 2, 4, 6, 8
c. 2, 6
*d. 0, 4, 8

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 6 BY SELECTING THE DIGIT(S) WHICH CAN BE USED IN THE ONES PLACE OF AN UNFINISHED NUMBER TO MAKE THE NUMBER DIVISIBLE BY 6. 0040

Which of the following can be used in the ones place of 395,82_ to make the completed number divisible by 6? 0054

a. 2, 6
*b. 0, 6
c. 4, 8
d. 0, 2, 6
e. 0, 3, 6, 9

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RULE FOR DIVISIBILITY BY 9 BY SELECTING THE DIGIT(S) WHICH CAN BE USED IN THE ONES PLACE OF AN UNFINISHED NUMBER TO MAKE THE NUMBER DIVISIBLE BY 9. 0041

Which of the following can be used in the ones place of 3,244,61_ to make the completed number divisible by 9? 0055

a. 6
b. 8
c. 5
*d. 7
e. not given

Source: School Mathematics, II, p. 120.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE SOLUTION TO A DIVISION PROBLEM BY IDENTIFYING A SUGGESTED SOLUTION WHICH IS INCORRECT. 0171

Which of the problems below is incorrect? 0513

a. $\begin{array}{r|r|l} 20 & 100 & \\ & \underline{-100} & 5 \times 20 \\ & 100 & \\ & \underline{-100} & 5 \times 20 \\ & 0 & \end{array}$

b. $\begin{array}{r|r|l} 30 & 100 & \\ & \underline{-90} & 3 \times 30 \\ & 10 & \end{array}$

c. $\begin{array}{r|r|l} 21 & 105 & \\ & \underline{-105} & 5 \times 21 \\ & 0 & \\ & \underline{-0} & 0 \times 21 \\ & 0 & \end{array}$

*d. $\begin{array}{r|r|l} 33 & 300 & \\ & \underline{-300} & 10 \times 33 \\ & 0 & \end{array}$

THE STUDENT WILL ANALYZE LONG DIVISION BY SELECTING FROM A LIST OF SEQUENCES OF OPERATIONS THE ONE WHICH DISPLAYS A LOGICAL PROGRESSION TOWARD THE SOLUTION. 0208

Directions: Given the following problem and an incomplete list of steps taken in its solution choose from below the one series of steps which is in proper order. 0566

$45\,\overline{)\,440{,}655}$

1. does 45 go into 35?
2. 9 x 45 = 405
3. does 45 go into 44?
4. 440 - 405 = 35
5. does 45 go into 440?

a. 5,3,2,4,1
b. 3,2,5,4,1
c. 1,3,5,2,4
*d. 3,5,2,4,1
e. 5,2,3,4,1

THE STUDENT WILL ANALYZE METHODS OF DIVISION BY SELECTING FROM A LIST A METHOD WHICH WILL WORK BUT WHICH HAS NOT BEEN FORMALLY TAUGHT TO HIM. 0221

Which of the following methods of division would be of most use to a person who did __not__ know how to multiply but who needed a method that would work for __any__ division problem? 0589

*a.
$$\begin{array}{rrl} 90 & \overline{)\,350} & \\ & \underline{-90} & 1 \\ & 260 & \\ & \underline{-90} & 1 \\ & 170 & \\ & \underline{-90} & \underline{1} \\ & 80 & 3 \text{ r } 80 \end{array}$$

b. $9\,\overline{)\,25}$

quotient will be first digit of dividend
remainder will be sum of digits of dividend (2 + 5 = 7)

c.
$22\,\overline{)\,308}$
$11\,\overline{)\,154}$
$5\,\overline{)\,77}$
$2\,\overline{)\,38}$
$1\,\overline{)\,19}$

d. $50\,\overline{)\,450}$

Quotient: Add digits of dividend to find answer.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF THE WORD "RECIPROCAL" BY IDENTIFYING THE WORD WHICH COMPLETES A SENTENCE INVOLVING THE WORD RECIPROCAL. 0013

The product of any number and its reciprocal is 0016

a. the number itself
b. zero
*c. one
d. the numbers inverse
e. none of the above

Source: Advancing in Mathematics, SRA, Part 8.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO ESTIMATE THE SQUARE ROOT OF A NUMBER BY IDENTIFYING THE TWO MULTIPLES OF 10 (or 100) BETWEEN WHICH THE SQUARE ROOT LIES. 0065

Between which two numbers is the square root of 1764? 0096

a. 10 and 20
b. 20 and 30
c. 30 and 40
*d. 40 and 50
e. 50 and 60

Between which two numbers is the square root of 754,932? 0097

a. 400 and 500
b. 500 and 600
c. 600 and 700
d. 700 and 800
*e. 800 and 900

MODULAR ARITHMETIC AND BASES

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF MODULAR ARITHMETIC BY RECOGNIZING THE SOLUTION SETS OF DIFFERENT MATHEMATICAL EQUATIONS. 0002

The solution set of the equation $x + x = 2 \pmod{4}$ is 0003

a. 3
b. 1
*c. 1,3
d. 2
e. 2,3

Source: Insight into School Mathematics, SRA, Book 2, p. 405.

THE STUDENT WILL BE ABLE TO DETERMINE WHETHER A NUMBERAL IS RENAMED CORRECTLY IN ANY BASE 2 THROUGH 10 BY IDENTIFYING SUCH FORMS. 0022

Which of the following is renamed correctly? 0030

a. $35_{(8)} = (3 \cdot 10) + (5 \cdot 1)$
b. $48_{(8)} = (4 \cdot 8) + (8 \cdot 1)$
*c. $57_{(8)} = (5 \cdot 8) + (1 \cdot 7)$
d. $64 = (6 \cdot 8) + (1 \cdot 4)$

Source: School Mathematics II, chapter one.

THE STUDENT WILL BE ABLE TO DETERMINE WHETHER A NUMERAL IS WRITTEN CORRECTLY IN ANY BASE 2 THROUGH 10 BY IDENTIFYING SUCH FORMS. 0023

Which of the following is NOT correctly expressed? 0031

a. $1110_{(2)}$
*b. $1120_{92)}$
c. $34_{(8)}$
d. $777_{98)}$

Source: School Mathematics II, Chapter one.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS COMPREHENSION OF THE BINARY NUMBER SYSTEM BY RECOGNIZING THE SOLUTIONS TO NEW PROBLEMS ON DETERMINING THE SIZE OF VARIOUS BINARY NUMBERS. 0025

The binary numeral 000000 indicates a white dot on a picture.
The binary numeral 111111 indicates a black dot.

Which of the following represents the lightest shade of gray which is not white? 0034

a. 111110
b. 100000
*c. 000001
d. 011111

Which of the following represents the shade of gray closest to midway between white and black? 0035

*a. 100000
b. 101010
c. 111000
d. 000111

Source: School Mathematics, II, p. 28.

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF NUMBER BASES BY RENAMING A BASE 10 NUMBER AS A NUMERAL IN A BASE ABOVE BASE 10. 0026

Suppose we let the symbol t stand for the number ten and the symbol e stand for the number eleven. How would you write a numeral for 178 in a base twelve system? 0036

a. $1210_{(12)}$
*b. $12t_{(12)}$
c. $tet_{(12)}$
d. $70t_{(12)}$

Source: School Mathematics II, p. 30.

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF VARIOUS NUMBER BASES BY IDENTIFYING THE BASE IN WHICH A CERTAIN EXERCISE HAS BEEN COMPLETED. 0044

What base must X stand for in $65_{(x)} + 46_{(x)} = 144_{(x)}$? 0059

a. x = 6
*b. x = 7
c. x = 8
d. x = 9
e. x = 10

What base must X stand for in $412_{(x)} - 244_{(x)} = 124_{(x)}$? 0060

a. x = 5
*b. x = 6
c. x = 7
d. x = 8
e. x = 9

Source: S.R.A. Advancing in Mathematics, part 1.

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF VARIOUS NUMBER BASES BY SELECTING THE NUMBER WHICH IS EQUAL TO A GIVEN NUMBER IN A DIFFERENT BASE. 0045

Which of the following is equal to $54_{(7)}$? 0061

a. $46_{(8)}$
b. $220_{(4)}$
c. $100110_{(2)}$
*d. $124_{(5)}$
e. $130_{(60}$

Source: S.R.A. Advancing in Mathematics, part I.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF NUMERALS NEEDED IN THE BINARY AND DECIMAL NUMERATION SYSTEMS TO GENERALIZE THE NUMERAL REQUIREMENTS FOR OTHER NUMBER SYSTEMS BY SELECTING THE CORRECT GENERAL RULE AND APPLYING IT. 0156

The binary numeral systems uses two digits, 0 and 1. The largest digit is 1. The decimal numeral system uses 10 digits. Its largest digit is 9.

How many digits are needed to express numbers in the numeral system that uses n as a base. 0439

a. n-2
b. n - 1
c. n + 1
d. n + 2
*e. n

What is the largest digit in a numeral system that uses n as a base? 0440

a. n - 2
*b. n - 1
c. n + 1
d. n + 2
e. n

Match one of the following to each of the statements below. Any number may be used once, more than once, or not at all.

a. 9
b. 8
c. 7
d. 6
e. 5

The largest numeral in a base 8 system is _c_ 0441

A base eight system has _b_ digits. 0442

A base nine system has _a_ digits. 0443

The largest numeral in a base nine system is _b._ 0444

The largest numeral in a base seven system is _d_. 0445

Source: Silver-Burdett, Foundation of Secondary School Math—Part I p. 36.

THE STUDENT WILL APPLY PRINCIPLES OF CHANGING FROM ONE NUMERATION SYSTEM TO ANOTHER TO ANSWER QUESTIONS POSED BY A WORD PROBLEM. 0157

Directions: According to a science fiction story, Earth was being visited by Martians. The leader of the Martians sent the following message to Earth. "We are landing an advance force of 1,111 men. We have 11 ships with 101 men in each ship." When the first ship landed, there were only 65 men aboard each ship."

Which of the following is a correct mathematical explanation of this difference between the number expected and the number which actually arrived? 0446

a. Martians used a base 2 numeration system.
b. Mars was invaded before this trip and a number of their men were captured.
c. The Martian leader could not count very well.
*d. Martians use a base 8 numeration system.
e. Martians use a base 12 numeration system.

If Mars used a base 5 numeration system, how many ships would arrive? 0447

a. 55
*b. 6
c. 15
d. 11
e. 2

If Mars used a base 4 numeration system, how many men are in the advance force? 0448

a. 340
b. 40
c. 16
d. 1,111
*e. 85

Source: Silver-Burdett, Foundation of Secondary School Math-- Part I, pp. 32,33.

THE STUDENT WILL SHOW HIS UNDERSTANDING OF BASE 2 NUMERATION SYSTEM BY FINDING EQUIVALENT NUMERALS IN THE DECIMAL SYSTEM TO ANSWER QUESTIONS WRITTEN IN BASE 2. 0158

Which of the following statements is true? 0449

I. There are 110_{two} positions on a girls' basketball team.
II. There were 111001_{two} days in February in 1964.
III. Humans have 10100_{two} fingers and toes.
IV. There are 1101_{two} inches in a foot.
V. There 1100_{two} men on an American football team.

a. I
b. II
*c. III
d. IV
e. V

Source: Silver-Burdett, Foundations of Secondary School Math— Part I. pp. 32,33.

THE PUPIL WILL DEMONSTRATE HIS ABILITY TO APPLY THE CONCEPTS USED IN CHANGING A NUMBER IN BASE 2 NUMERATION TO BASE 10 BY REWRITING NUMERALS IN OTHER NUMBER BASES TO BASE 10 NUMERATION. 0159

Given that

$$\begin{aligned} 1011_{two} &= (1x2^3) + (0x2^2) + (1x2^1) + (ox2^0) \\ &= (1x8) + (0 \times 4) + (1x2) + (0x1) \\ &= 8 + 0 + 2 + 0 \\ &= 10 \end{aligned}$$

What if the equivalent decimal numeral for 1234_{five}? 0450

a. 54
b. 144
*c. 194
d. 120
e. 970

What is the equivalent decimal numeral for 246_{seven}? 0451

a. 140
b. 434
c. 41
*d. 132
e. 924

Source: Silver-Burdett, Foundations of Secondary School Math—Part I, pp. 32,33.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF ADDITION AND SUBTRACTION OF WHOLE NUMBERS AND THE SUBSTITUTION PRINCIPLE BY SELECTING THE CORRECT ANSWERS TO PROBLEMS IN BASE 2, BASE 10 AND BASE 12. 0160

Directions: Match each addition problem below with its correct answer from the following list.

a. 808_{twelve}
b. 706_{twelve}
c. $23TT_{\text{twelve}}$
d. $19E11_{\text{twelve}}$
e. $4E9_{\text{twelve}}$

$12E_{\text{twelve}} + 597_{\text{twelve}}$ $\underline{\text{ b }}$ 0452

$TE13_{\text{twelve}} + TEET_{\text{twelve}}$ $\underline{\text{ d }}$ 0453

$3TE_{\text{twelve}} + 419_{\text{twelve}}$ $\underline{\text{ a }}$ 0454

Directions: Match each subtraction problem below with its correct answer from the following list.

a. 111010_{two}
b. $1E_{\text{twelve}}$
c. 110011_{two}
d. $1T_{\text{twelve}}$
e. 58_{twelve}

$63_{\text{twelve}} - 7_{\text{twelve}}$ e 0455

$5T_{\text{twelve}} = 3E_{\text{twelve}}$ b 0456

$111111_{\text{two}} - 101_{\text{two}}$ a 0457

Directions: Match each number sentence below with the replacement for n that will make it true.

a. $n_{\text{twelve}} = 1ET_{\text{twelve}}$
b. $n_{\text{twelve}} = TE_{\text{twelve}}$
c. $n_{\text{twelve}} = 132_{\text{twelve}}$
d. $n = 27$
e. $n = 84$

$51 + n = 78$ d 0458

$n + 31 = 115$ e 0459

$79_{\text{twelve}} + n_{\text{twelve}} = 1TE_{\text{twelve}}$ c 0460

Source: Silver-Burdett, Foundations of Secondary School Math— Part I, pp. 38-42.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF BASE 12 NUMERATION BY CONVERTING BASE 12 TO BASE 10 AND DECIMAL TO DUODECIMAL NUMERATION. 0162

Directions: Use T as the symbol for ten and E as the symbol for eleven in the duodecimal (base 12) numeration system. How many places are required to write each of the following in the duodecimal system? Let:

a = 1
b = 2
c = 3
d = 4
e = 5

92 b 0463

63 b 0464

64 b 0465

420 c 0466

129 b 0467

Directions: Which of the following list of numerals represents one more than the numerals named below?

a. 393_{twelve}
b. TEE_{twelve}
c. $99T_{twelve}$
d. $E00_{twelve}$
e. 960_{twelve}

TEE d 0468

TET b 0469

95E e 0470

999 c 0471

Which of the following represents 1871 in base twelve numeration? 0472

a. 1871_{twelve}
*b. $10EE_{twelve}$
c. TET_{twelve}
d. ETT_{twelve}
e. $T871_{twelve}$

Which of the following represents 10TE in decimal numeration? 0473

a. 31
b. 111
*c. 1859
d. 20,892
e. 1883

THE STUDENT WILL SHOW HIS UNDERSTANDING OF CONVERTING DECIMAL NUMERATION TO BINARY NUMERATION AND BASE 2 TO BASE 10 NUMERATION BY CONVERTING OTHER NUMBER BASES. 0163

Which of the following is NOT true? 0474

a. $15 = 21_{\text{seven}}$
b. $15 = 30_{\text{five}}$
c. $15 = 33_{\text{four}}$
*d. $15 = 16_{\text{eight}}$
e. $15 = 23_{\text{six}}$

Which of the following is NOT true? 0475

a. $130_{\text{five}} = 40$
b. $3213_{\text{five}} = 433$
c. $204_{\text{five}} = 54$
d. $11200_{\text{four}} = 352$
*e. $2001_{\text{four}} = 131$

Which of the following is NOT true? 0476

a. $26_{\text{eight}} = 31_{\text{seven}}$
b. $24_{\text{nine}} = 42_{\text{five}}$
*c. $204_{\text{five}} = 104_{\text{seven}}$
d. $2121_{\text{three}} = 154_{\text{six}}$

Source: Silver-Burdett, Found. of Secondary School Math—Part I, pp. 32-36.

THE STUDENT WILL USE HIS KNOWLEDGE OF THE METHOD OF FINDING THE LARGEST POWER OF TWO TO FIND THE BASE 2 NUMERAL THAT IS EQUIVALENT TO A GIVEN DECIMAL NUMERAL. 0164

Directions: Express 307 in the binary system.

What is the highest power of two that is less than 307? 0477

a. 64
*b. 356
c. 306
d. 132
e. 264

What is 307 in base 2 numeration? 0478

a. 10110010_{two}
b. 10011001_{two}
*c. 100110010_{two}
d. 100010001_{two}
e. 100011001_{two}

Express 99 in the binary system. What is the remainder after division by the highest power of two that is less than 99? 0479

a. 67
b. 91
c. 83
*d. 35
e. 25

What is the second column in which the digit "1" is written? 0480

a. 2^6
*b. 2^5
c. 2^4
d. 2^3
e. 2^2

What is 99 in base 2 numeration? 0481

*a. 1100011_{two}
b. 1100010_{two}
c. 1101001_{two}
d. 1001110_{two}
e. 1001001_{two}

Directions: How many places are required to write each of the following in the binary system?

a. 6
b. 7
c. 8
d. 9
e. 10

92 b 0482

63 a 0483

64 b 0484

420 d 0485

129 c 0486

Source: Silver-Burdett, Found. of Secpmdary School Math--Part I, pp. 35.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF EVEN AND ODD NUMBERS IN BASE TEN BY IDENTIFYING EVEN AND ODD NUMBERS IN ANY NUMBER BASE. 0176

12 represents an even number in base 10 but an odd number in base 7. Similarly 100 can represent an even number or odd number depending on the number base. In any number base any number: 0518

*a. written with digits from the set of even numbers is even.
b. written with digits from the set of odd numbers is odd.
c. with an even number of digits is even.
d. with an odd number of digits is odd.

THE STUDENT WILL ANALYZE A GENERALIZATION FOR ALL NUMBER BASES BY IDENTIFYING A FORMULA WHICH STATES THIS GENERALIZATION. 0177

The simplest statement of a generalization about the value in base ten of the largest number that can be written with a given number of digits in a given number base is 0519

- *a. b^n-1, where b is the value of the base written in base ten and n is the number of digits written in base ten
- b. $(n-1)(n^0 + n^1 + n^2 + n^3 \ldots)$ where n is the number of digits written in base 10
- c. $n(n^0 + n^1 + n^2 + n^3 \ldots)$ where n is the value of the base written in base ten
- d. $(b-1)(b^0 + b^1 + b^2 + b^3 \ldots b^{n-1})$ where "n" is the number of digits written in base ten and "b" is the value of the base written in base ten

THE STUDENT WILL FORM A GENERALIZATION FROM THE DATA SUPPLIED BY THE NUMBER FACTS OF AN UNFAMILIAR NUMBER SYSTEM BY IDENTIFYING THE PRINCIPLES WHICH GOVERN BASIC OPERATIONS IN THAT NUMBER SYSTEM. 0183

Directions: Given the number facts below which statement is true about the indicated operations in that number system.

0526

+	0	1	2	3
0	0	1	2	3
1	1	2	3	0
2	2	3	0	1
3	3	0	1	2

x	0	1	2	3
0	0	0	0	0
1	0	1	2	3
2	0	2	0	2
3	0	3	2	3

- a. Addition is commutative but not associative.
- b. The identity principle for addition but not multiplication.
- c. Multiplication is not distributive with respect to addition.
- *d. Division does not have the uniqueness property.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE DIFFERENCE BETWEEN NUMERAL AND NUMBER BY WRITING DIVISIBILITY RULES FOR THE SAME SET OF NUMBERS IN DIFFERENT NUMBER BASES. 0185

Adding the digits and dividing by 3 is the divisibility test for 3 in base 0538

a. five
b. six
*c. ten
d. twelve

THE STUDENT WILL APPLY HIS KNOWLEDGE OF DECIMAL NUMERATION SYSTEM TO OTHER BASE SYSTEMS, BY SELECTING FROM A LIST THE DECIMAL VALUE OF FRACTIONS IN OTHER BASES. 0230

Directions: The student knows that in the decimal system each place has a place value which is some power of ten; those to the left of the decimal point represent positive powers of ten, and those to the left of the decimal point represent negative powers of ten. Using these ideas, what are the following numbers equal to in base 10?

$3.021_{\text{base } 4}$ 0612

a. $3.021_{\text{base } 10}$
b. $3\frac{21}{1000}_{\text{base } 10}$
c. $3\,\frac{21}{64}_{\text{base } 10}$
*d. $3\,\frac{9}{64}_{\text{base } 10}$
e. $3\,\frac{9}{100}_{\text{base } 10}$

$3.021_{\text{base } 5}$ 0613

a. $3\frac{21}{5}_{\text{base } 10}$

b. $3\frac{11}{25}_{\text{base } 10}$

*c. $3.088_{\text{base } 10}$

d. $3.021_{\text{base } 10}$

e. $3\ \frac{21}{1000}_{\text{base } 10}$

$11.011_{\text{base } 2}$ 0614

a. $3.011_{\text{base } 10}$

b. $11.03_{\text{base } 10}$

c. $3\frac{3}{2}_{\text{base } 10}$

d. $3\frac{3}{11}_{\text{base } 10}$

*e. $3.375_{\text{base } 10}$

THE STUDENT WILL ANALYZE STATEMENTS ABOUT COMPARISONS OF FRACTIONS IN DIFFERENT BASES AND CHOOSE A TRUE STATEMENT FROM A LIST. 0232

Select from the following list the item which is always true about comparing fractions in different bases. 0620

a. $\frac{\triangle}{\square}(a) = \frac{\triangle}{\square}(b)$ if $\triangle < \square$ and $a > b$

b. $\frac{\triangle}{\square}(a) \neq \frac{\triangle}{\square}(b)$ if $\square > \triangle$ for any a and b

*c. $\frac{\triangle}{\square}(a) = \frac{\triangle}{\square}(b)$ if $\triangle + \square < a$ and $\triangle + \square < b$ for any a and b

d. $\frac{\triangle}{\square}(a) = \frac{\triangle}{\square}(10)$ if $a < 10$

e. $\frac{\triangle}{\square}(a) \neq \frac{\triangle}{\square}(b)$ if $a \neq b$

THE STUDENT CAN ANALYZE VARIOUS CLOCK SYSTEMS BY CHOOSING WHICH SYSTEM, NOT SPECIFICALLY STUDIED, INCLUDES A FIELD OR WHICH DOES NOT. 0236

Mark the letter of the clock system which includes a field 0628

a. S 6
*b. S 7
c. S 8
d. S 9
e. S 10

Mark the letter of the clock system which does not include a field. 0629

a. S 3
b. S 5
c. S 7
*d. S 9
e. S 11

THE STUDENT CAN COMPREHEND THE PROPERTIES OF THE CLOCK SYSTEM BY IDENTIFYING THE PROPERTY FOR A GIVEN NUMBER SENTENCE OR BY IDENTIFYING A NUMBER SENTENCE FOR A GIVEN PROPERTY. 0237

Mark the correct letter for the definition of this number sentence. For all numbers x and y in S_3 $(x + y) \in S\ 3$ (recall that $\in$ means "is a member of") 0630

a. Commutative property of addition.
*b. Closure property of addition.
c. Associative property of addition.
d. Distributive property of multiplication over addition.
e. Property of additive Inverse.

Mark the letter of the correct number sentence for the distributive property of multiplication over addition. 0631

*a. For all numbers x, y, and z, in S_3 $x\ (y + z) = (xy) + (xz)$
b. For all numbers x, y, and z in S_3 $(xy)\ z = x\ (yz)$
c. For all numbers x and y in S_3 $xy = yz$
d. For all numbers x and y in S_3 $(xy) \in S\ 3$ ($\in$ means " is a member of")

Source: Nichols, 8 Mathematics, Structure and Patterns, Holt.

THE STUDENT CAN APPLY THE PRINCIPLE OF A 5 CLOCK SYSTEM BY CALCULATING A SIMPLE PROBLEM IN ANOTHER CLOCK NUMBER SYSTEM. 0238

In S 5, 4 x 2 = 3; therefore in S 11, 4 x 5 = ________. 0632

a. 20
*b. 9
c. 8
d. 10

In S 5, 1 ÷ 4 = 4; therefore in S 6, 1 ÷ 5 = ________. 0633

a. 1
b. 4
c. 6
*d. 5

THE STUDENT CAN DEMONSTRATE HIS KNOWLEDGE OF THE 2 BINARY OPERATIONS IN THE FINITE NUMBER SYSTEMS BY PERFORMING THESE 2 BINARY OPERATIONS. 0239

In the 3 number system 2 + 1 = ________ 0634

- *a. 0
- b. 1
- c. 2
- d. 3

In the 4 number system 0 - 1 = ________ 0635

- a. 0
- b. 1
- c. 2
- *d. 3
- e. 4

In the 5 number system 2 x 3 = ________ 0636

- a. 0
- *b. 1
- c. 2
- d. 3
- e. 4

In the 6 number system 5 ÷ 1 = ________ 0637

- a. 0
- b. 1
- c. 3
- *d. 5

THE STUDENT CAN ANALYZE THE CLOCK SYSTEMS BY CHOOSING THE CRITERIA WHICH ARE NOT TRUE. 0240

Choose the criterion which is not completely true among the following criteria for all clock systems. 0638

a. All clock systems have the closure properties of addition and multiplication.
*b. The properties of Additive Inverse and Multiplicative Inverse are true for all clock systems.
c. The Distributive Property of Multiplication over Addition is true for all clock systems.
d. The commutative Properties of Addition and Multiplication are true for all clock systems.

THE STUDENT CAN EVALUATE THE PROPERTIES OF THE CLOCK SYSTEM BY IDENTIFYING THE PROPERTIES THAT ARE MOST SIGNIFICANT AMONG TRUE PROPERTIES. 0241

Choose the best criterion for the clock system among the following true statements. 0639

a. All clock systems have the closure properties of addition and of multiplication.
*b. The multiplicative inverse is not true for all clock systems but all other properties in the Field are true.
c. The properties of Additive Identity and Multiplicative Identity are true in all clock systems.
d. All properties in the Field are true for prime number clock systems.

THE STUDENT CAN RECALL THE PROCESS OF MULTIPLICATION IN BASE FIVE AS SHOWN BY HIS ABILITY TO SELECT THE PRODUCT, IN BASE FIVE, OF TWO NUMBERS. 0245

The product of 100_{five} x 3 $\underline{\qquad}_{five}$ in base five is 0645

a. 110_{five}
b. 500_{five}
c. 75_{five}
*d. 300_{five}

The product of $100_{five} \times 11_{five}$ ______$_{five}$ in base five is 0646

a. 100_{five}
*b. 1100_{five}
c. 41100_{five}
d. 150_{five}

THE STUDENT CAN DEMONSTRATE HIS COMPREHENSION OF BASE TWO SYSTEM BY CONVERTING BASE TEN SYSTEM TO BASE TWO SYSTEM AND BASE TWO NUMERALS TO BASE TEN NUMERALS. 0251

In the following list, mark the wrong conversion from Base 10 to Base 2. 0658

a. $1_{ten} = 1_{two}$
b. $2_{ten} = 10_{two}$
c. $3_{ten} = 11_{two}$
d. $4_{ten} = 100_{two}$
*e. $5_{ten} = 110_{two}$

In the following list, mark the wrong conversion from Base Ten Numerals to Base Two Numerals. 0659

a. $6_{ten} = 110_{two}$
b. $7_{ten} = 111_{two}$
*c. $9_{ten} = 1100_{two}$
d. $11_{ten} = 1011$
e. $20_{ten} = 10100_{two}$

In the following list mark the right conversion from Base Two Numerals to Base Ten Numerals. 0660

a. 100,110 = 72
*b. 1,000,000 = 64
c. 1,100,000 = 90
d. 1,100,001 = 60

THE STUDENT CAN RECALL THE BASE TWO SYSTEM BY SIGNIFYING THE CORRECT PLACE VALUES - OR RECOGNIZING THE INCORRECT PLACE VALUES. 0253

Choose the correct Place Value schema for Base Two System. 0663

*a. 32, 16, 8, 4, 2, 1
b. 10, 8, 6, 4, 2, 1
c. 16, 12, 8, 4, 2, 1
d. 12, 8, 6, 4, 2, 1

Choose the number that is wrong in Base Two System of Place Values. 0664

*a. 12
b. 8
c. 4
d. 2
e. 1

THE STUDENT CAN JUDGE THE PURPOSE OF ALGORITHMS BY ANALYZING THOSE PURPOSES AND RECOGNIZING THE ONE WHICH WILL AID HIM IN APPLYING THE SAME SYSTEMATIC PROCEDURES TO OTHER BASE SYSTEMS. 0258

What is the value of learning algorithms in Base Ten before learning other Base Systems? Signify by marking the reason which makes learning new Bases more understandable. In the algorithms of arithmetic. 0673

a. The methods you have been using are given names.
b. The systematic procedure makes a list, easily learned, of the necessary steps involved.
*c. The numerals are disassembled giving them place value in order to demonstrate the processes systematically used.
d. a student will convert each number which is not in Base Ten into Base Ten to perform the arithmetical operations.

THE PUPIL CAN ANALYZE A PROBLEM IN THE BINARY SYSTEM AS INDICATED BY HIS IDENTIFYING THE MISTAKE IN EACH PROBLEM. 0262

Mark the mistake in the following subtraction problem in the Binary System by marking the letter of the column in which the mistake is made. 0683

a	b	c	d	e	
1	1	0	0	1	two
−		1	1	1	two
1	0	1	1	0	

a.
b.
*c.
d.
e.

Mark the mistake in the following addition problem in the Binary System by marking the letter of the column in which the mistake is made. 0684

	a	b	c	d	e	
		1	0	1	1	two
+			1	1	1	two
	1	0	0	0	0	two

a.
b.
c.
*d.
e.

Mark the mistake in the following multiplication problem in the Binary System by marking the letter of the column in which the mistake is made. 0685

```
     a   b   c   d   e
    -------------------
         1   0   1   1   two
                x1   1   two
        ---------------
         1   1   1   1
     1   0   1   1
    -------------------
 1   0   0   1   0   1   two
```

a.
b.
*c.
d.
e.

Mark the mistake in the following division problem in the Binary System by marking the letter of the column in which the mistake is made. 0686

```
                        a   b   c   d   e
                        -----------------
                            1   1   1   1   two
        -------------------------------------
1 1 1 two       1   0   0   0   1   0   1   two
                1   1   1
                ---------
                    1   0   1   0
                        1   1   1
                    -------------
                            1   1   1
                            1   1   1
                            ---------
                                    0
```

a.
b.
*c.
d.
e.

FRACTIONS, DECIMALS AND PROPORTIONS

THE STUDENT WILL EVALUATE THE USEFULNESS OF KNOWLEDGE OF FRACTIONAL NUMBERS BY PREDICTING DIFFICULTIES THAT WOULD ARISE WITHOUT KNOWLEDGE OF THESE NUMBERS AND WITHOUT SYMBOLS TO REPRESENT THEM. 0199

Imagine a number system which did not include symbols for or a knowledge of what we call fractions. Those who used such a number system would only have knowledge of whole numbers. If you belonged to a civilization which used only whole numbers you would have the most difficulty 0556

a. keeping track of your property.
*b. paying your income tax.
c. carrying on business.
d. building your house.

THE STUDENT CAN ANALYZE SOLUTIONS TO PROBLEMS IN FRACTIONS AS INDICATED BY HIS MARKING THE WRONG SOLUTIONS. 0261

Mark the wrong solution to the following problem 0679
1 1/2 + 2 2/3 + 3 1/5 = ?

*a. (1 + 1/2) + (2 + 2/3) + (3 + 1/5) =
(1 + 2 + 3) + (1/2 + 2/3 + 1/5) =
6 + (15/30 + 10/30 + 6/30 = 6 + 31/30 = 7 11/30

b. (1 + 1/2) + (2 + 2/3) + 3 + 1/5) =
(1 + 2 + 3) + (1/2 + 2/3 + 1/5 =
6 + (15/30 + 20/30 + 6/30) = 6 + 41/30 = 7 11/30

c. (1 + 1/2) + (2 + 2/3) + (3 + 1/5) =
(1 + 2) + (1/2 + 2/3) + (3 + 1/5) =
3 + (3/6 + 4/6) + 3 + 1/5 =
3 + 7/6 + 3 + 1/5 =
3 + (1 1/6) + 3 + 1/5 =
7 + (1/6 + 1/5) = 7(5/30 + 6/30) = 7 11/30

d. (1 + 1/2) + (2 + 2/3) + (3 + 1/5) =
6 + (1/2 + 2/3 + 1/5) = $\frac{6 + 15 + 20 + 6}{30}$ = 6 41/30 = 7 11/30

Mark the wrong solution to the following problem. 0680

$7\,1/2 - 2\,5/6 = ?$

a.
$$\begin{array}{llll} 7\,1/2 = & 6 + 1 + 1/2 = & 6 + 3/2 = & 6 + 9/6 \\ \underline{-2\,5/6} = & \underline{\quad 2 + 5/6} = & \underline{2 + 5/6} = & \underline{2 + 5/6} \\ & & & 4\,4/6 = 4\,2/3 \end{array}$$

b.
$$\begin{array}{l} 7\,1/2 - 2\,5/6 = \\ [(6 + 1) + 1/2] - [2 + 5/6] = \\ (6 + 2/2 + 1/2) - (2 + 5/6) = \\ (6 - 2) + (3/2 - 5/6) = \\ 4 + (9/6 - 5/6) = \\ 4 + 4/6 = 4\,2/3 \end{array}$$

c.
$$\begin{array}{lll} 7\,1/2 = & 15/2 = & 45/6 \\ \underline{-2\,5/6} = & \underline{-17/6} = & \underline{-17/6} = \\ & & 28/6 = 4\,4/6 = 4\,2/3 \end{array}$$

d.
$$\begin{array}{lll} 7\,1/2 = & 7\,3/6 = & 6\,9/6 \\ \underline{-2\,5/6} = & & \underline{-2\,5/6} \\ & & 4\,4/6 = 4\,2/3 \end{array}$$

*e.
$$\begin{array}{ll} 7\,1/2 = & 7\,3/6 \\ \underline{-2\,5/6} = & \underline{2\,5/6} \\ & 4\,8/6 = 4\,2/3 \end{array}$$

Mark the wrong solution to the following problem 0681

$2\,1/2 \times 3\,2/3 = ?$

a.
$$\begin{array}{l} 2\,1/2 \times 3\,2/3 = \\ (2 \times 3) + (1/2 \times 2/3) + (1/2 \times 3) + (2 \times 2/3 = \\ 6 \quad 6 \quad + \quad 1/3 \quad + \quad 3/2 \quad + \quad 4/3 = \\ \quad 6 + (1/3 + 4/3) + 3/2 = \\ \quad 6 + 5/3 + 3/2 = 7(2/3 + 3/2) = 7 + (4/6 + 9/6) = \\ \quad 7\,13/6 = 9\,1/6 \end{array}$$

b. $2\,1/2 \times 3\,2/3 = 5/2 \times 11/3 = 55/6 = 9\,1/6$

*c.
$$\begin{array}{l} 2\,1/2 \\ \underline{\times 3\,2/3} \\ (2\,1/2 \times 2/3) = (2 \times 2/3) + (1/2 \times 2/3) = (4/3 + 2/3) = \\ 5/3 = 1\,2/3 + (2\,1/2 \times 3) = (2 \times 3) + (1/2 \times 3) = \\ 6 + 3/2 + 7\,1/2 = 8 + (2/3 + 1/2) = 8 + (4/6 + 3/6) = \\ 8 + 7/6 = 9\,1/6 \end{array}$$

d.
$$\begin{array}{l} 2\,1/2 = 5/2 \; \left(\frac{5 \times 11}{2 \times 3}\right) = 55/6 = 8\,1/6 \\ \times 3\,2/3 = 11/3 \end{array}$$

Mark the wrong solution to the following problem. 0682

$1\ 2/3 \div 1/2 =$

a. $1\ 2/3 \div 1/2 = (5/3 \div 1/2) = (5/3 \times 2/1) = 10/3 = 3\ 1/3$

*b. $(1 \div 1/2) + (2/3 \div 1/2) = (1/2) + (2/3 \times 2/1) =$
$1/2 + 4/3 = 3/6 + 8/6 = 11/6 = 3\ 1/3$

c. $(1 \div 1/2) + (2/3 \div 1/2) = (1 \times 2) + (2/3 \times 2/1) =$
$(2 + 4/3) = 3\ 1/3$

d. $1\ 2/3 \div 1/2 = 1\ 2/2 \times 2 = 2\ 4/3 = 3\ 1/3$

THE STUDENT WILL BE ABLE TO DEMONSTRATE AN UNDERSTANDING OF FRACTIONS AS DECIMALS BY IDENTIFYING THE CORRECT TRANSLATION. 0001

The decimal which names the same number as the fraction 5/9 is: 0001

a. .55
b. .18
c. 1.8
*d. .555...
e. 5.555...

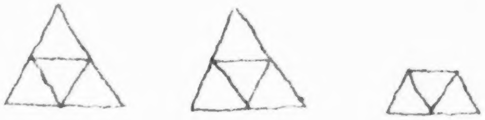
The decimal which names the same number as the fraction 3/5 is: 0002

a. .06
*b. .6
c. .03
d. .3
e. 3.5
f. .35

Source: Insight into School Mathematics, SRA, Book 2, p. 405.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF NUMERATOR AND DENOMINATOR BY MATCHING A GIVEN FRACTION WITH A DIAGRAM WHICH ILLUSTRATES THAT FRACTION. 0187

The figure below illustrates the fraction 0540



a. 2/3
b. 8/11
c. 5/6
*d. 11/4

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF EQUIVALENT FRACTIONS BY CHOOSING ONE FRACTION WHICH IS NOT EQUIVALENT TO ANY OTHER FRACTION IN THE LIST. 0043

Which of the fractions 6/8, 12/16, 2/3, 9/12, 3/4 is NOT equivalent to any of the other fractions given? 0057

a. 6/8
b. 12/16
*c. 2/3
d. 9/12
e. 3/4

Which of the fractions 8/18, 10/25, 6/15, 2/5, 14/35 is NOT equivalent to any of the other fractions given? 0058

*a. 8/18
b. 10/25
c. 6/15
d. 2/5
e. 14/35

Source: School Mathematics II, p. 129.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO DETERMINE THE RELATIVE SIZE OF FRACTIONS BY IDENTIFYING THE ORDER, FROM SMALLEST TO LARGEST, OF THREE GIVEN FRACTIONS WITH DIFFERENT DENOMINATORS. 0048

Arrange 8/12, 9/16, 5/8 in order from smallest to largest. 0069

a. 5/8, 9/16, 8/12
b. 5/8, 8/12, 9/16
c. 9/16, 8/12, 5/8
*d. 9/16, 5/8, 8/12
e. 8/12, 9/16, 5/8
f. 8/12, 5/8, 9/16

Arrange 1/8, 1/9, 1/10 in order from smallest to largest. 0070

a. 1/8, 1/9, 1/10
b. 1/8, 1/10, 1/9
c. 1/10, 1/8, 1/9
*d. 1/10, 1/9, 1/8
e. none of the above

Source: S.R.A. Advancing in Mathematics, part 4.

THE STUDENT WILL DEMONSTRATE ANALYSIS OF RULES FOR ADDING FRACTIONS BY SELECTING FROM A LIST THOSE RULES WHICH WOULD WORK IN A GIVEN SITUATION. 0217

Possible rules for adding fractions:

I. Add numerators. Use either denominator.
II. Add numerators. Add denominators.
III. Multiply first fraction's numerator and denominator by second fraction's denominator. Now add numerators and use new first denominator.
IV. Multiply first fraction's numerator and denominator by second fraction's denominator. Multiply second fraction's numerator and denominator by first fraction's denominator. Add new numerators. Use either denominator.
V. Multiply first numerator by second denominator, and second numerator by first denominator. Add these products to find sum's numerator. Sum's denominator is product of addends' denominators.

Directions: Choose the letter that gives a list of all valid rules for the problem given.

a. I, III, IV, V all work.
b. I, IV, V all work.
c. I, II, IV, V all work.
d. III, IV, V all work
e. IV and V only will work.

1/2 + 3/2	b	0578
1/2 + 1/4	e	0579
5/1 + 6/1	a	0580
7/11 + 9/11	b	0581
7/11 + 10/11	b	0582
3/8 + 0/8	b	0583
0/8 + 0/4	c	0584
3/8 + 0/1	d	0585

THE STUDENT WILL APPLY HIS KNOWLEDGE OF ADDITION OF FRACTIONS BY COMPARING AND CONTRASTING GENERALIZED RULES FOR SOLUTION OF SUCH PROBLEMS BY SELECTING VALID COMPARISONS AND CONTRASTS FROM A LIST. 0222

Example 3/1 + 5/6

Rule I: Multiply first fraction's numerator and denominator by second's denominator. Then add numerators and use either denominator.

Rule II: Multiply #1's numerator by #2's denominator, and #2's numerator by #1's denominator. Add these products for answer's numerator. Multiply denominators for answer's denominator.

From the list below, choose the statement that best compares and contrasts the two rules above. 0590

a. Neither rule will correctly solve the problem, so both aren't even worth comparison and contrasting.
b. The first rule will work for the example and all other fraction additions; the second works only on the specific type of example given.
*c. The second rule works for the example and for all other fraction additions; the first works only on the specific type of problem given.
d. Both rules work for the example and for all fraction additions.
e. Both rules work only for the specific example given and for no other problems.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF PROPORTIONS BY IDENTIFYING THE SOLUTION TO A PROPORTION. 0021

If 2:6 = 14; x, then x = 0027

a. 7
b. 4 2/3
c. 12
*d. 42
e. 28

If x:5 = 2 1/3 : 3 1/2, then x = 0028

*a. 3 1/3
b. 4
c. 1 3/7
d. 3
e. None of the above

If 1:x = 4:6 0029

a. 2
b. 3
c. 1 2/3
d. 2/3
*e. None of the above

Source: Advancing in Mathematics, SRA, part 13.

THE STUDENT WILL APPLY THE RULES OF DECIMAL NOTATION TO A UNIQUE DECIMAL PLACEMENT SYSTEM BY IDENTIFYING A NUMBER WRITTEN IN THAT SYSTEM. 0153

How would you read $532\dot{6}43$? 0433

a. Five hundred thirty two thousand and six hundred forty-three
b. Five hundred thirty two and six hundred forty-three thousandths
c. Five hundred thirty two thousand and six hundred forty-three thousandths
*d. Five thousand three hundred twenty-six and forty-three hundredths
e. Five thousand thirty-two and six hundred forty-three thousands.

Which of the following is correctly written in our new notational system where the expanded notation is (5 x 1000) + (2 x 100) + (8 x 10) + (7 x 1) + (8 x .1) + (2 x .01) 0434

a. $5287\dot{8}2$
*b. $528\dot{7}82$
c. $52\dot{8}782$
d. $52878\dot{2}$
e. $5\dot{2}8782$

Source: Found. of Secondary School Math—Part I, pp. 29-30.
Silver Burdett.

WORD PROBLEMS

THE STUDENT CAN TRANSLATE A STORY PROBLEM INTO A MATHEMATICAL SENTENCE BY IDENTIFYING THE CORRECT SENTENCE. 0007

John had $3.50 worth of nickels and quarters. The number of quarters is three more than twice the number of nickels. Which would be the correct equation for stating the problem? (N = number of nickels) 0009

a. $5N + 25(2N + 3) = \$3.50$
b. $5N + 25(2N) + 3 = \$3.50$
*c. $.05N + .25\,(2N + 3) = \$3.50$
d. $.05N + .25\,(2N) + 3 = \$3.50$
e. $N + 5N + 3 = \$.50$

Raquel's father is twice as old as Raquel. Five years ago Raquel was twenty years younger than her father. Which is a correct equation for stating the problem? (R = Raquel's age now) 0010

a. $R + 5 - 20 = 2R + 5$
b. $R - 5 - 20 = 2R + 5$
c. $R - 5 + 20 = 2(R-5)$
*d. $R - 5 + 20 = 2R - 5$
e. $R - 5 - 20 = 2(R - 5)$

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO TRANSLATE AN ENGLISH SENTENCE INTO A MATHEMATICAL SENTENCE BY IDENTIFYING THE CORRECT PROPORTION FOR A STORY PROBLEM. 0057

[Three students were absent out of a class of 30. What percent were absent?] Which of the following proportions would you use to represent the above problem? 0084

a. $\frac{3}{100} = \frac{30}{n}$
b. $\frac{30}{3} = \frac{n}{100}$
*c. $\frac{3}{30} = \frac{n}{100}$
d. $\frac{3}{30} = \frac{100}{n}$
e. $\frac{30}{100} = \frac{n}{3}$

[In the growing town of West Walla Walla, Washington, 70% of the 2578 people are over 50 years old. How many people are over 50 years old?] Which of the following proportions would you use to represent the above problem? 0085

a. $\frac{70}{100} = \frac{n}{50}$
b. $\frac{70}{100} = \frac{50}{n}$
c. $\frac{70}{100} = \frac{2578}{n}$
*d. $\frac{70}{100} = \frac{n}{2578}$
e. $\frac{n}{100} = \frac{50}{70}$

Source: School Mathematics II, chapter 8.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO CHOOSE THE CORRECT OPERATION(S) TO SOLVE A STORY PROBLEM BY IDENTIFYING THE OPERATION(S) NEEDED FOR A GIVEN PROBLEM. 0063

[________ students in class. ________ students in the cafeteria. How many more in the cafeteria than in class?] If numbers were given in the above problem, which operation or operations would be needed to solve it? 0091

a. addition
*b. subtraction
c. multiplication
d. multiplication and subtraction
e. division

[________pencils given out. ________ pencils to each person. How many people?] If numbers were given in the above problem, which operation would be needed to solve it? 0092

a. addition
b. subtraction
c. multiplication
*d. division

[_______ pencils for _______ cents each. _______ notebooks for _______ cents each. How much more do all the notebooks cost than all the pencils?] If numbers were given in the above problem, which operations would be needed to solve it? 0093

*a. multiplication and subtraction
b. division and subtraction
c. multiplication and addition
d. division and addition

[Jack's vacation: ______ weeks. Dick's vacation: _____ weeks. How many more days does Dick have? If numbers were given in the above problem, which operations would be needed to solve it? 0094

a. multiplication and division
*b. multiplication and subtraction
c. division and subtraction
d. division and addition
e. multiplication and addition

Source: School Mathematics I, Chapter 2.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO RECOGNIZE WHAT INFORMATION IN A STORY PROBLEM IS NEEDED TO SOLVE IT BY IDENTIFYING UNNECESSARY INFORMATION. 0066

[A car is traveling 75 miles per hour. It uses gasoline at the rate of 15 miles per gallon. How long will it take to travel 150 miles?] What information in the above problem is NOT needed to solve the problem? 0098

a. A car is traveling 75 miles per hour.
*b. It uses gasoline at the rate of 15 miles per gallon.
c. The car travels 150 miles.
d. All the information is needed.

[One inch is approximately equal to 2.54 centimeters. There are 100 centimeters in a meter. There are 36 inches in a yard. About how many centimeters are in one yard?] What information in the above problem is NOT needed to solve the problem? 0099

a. One inch is approximately equal to 2.54 centimeters
*b. There are 100 centimeters in a meter.
c. There are 36 inches in a yard.
d. All the information is needed.

Source: School Mathematics I, Chapter 4.

THE STUDENT CAN DEMONSTRATE UNDERSTANDING OF SOLUTION METHODS FOR WORD PROBLEMS BY TRANSLATING A WORD PHRASE INTO A MATHEMATICAL EXPRESSION. 0073

Which mathematical sentence is a translation of "the product of the sum of j and 3 and the difference of x and 4"? 0116

a. $(j - 3)\ (x - 4)$
b. $(j + 3)\ (4 - x)$
c. $(j + 3 + (4 - x)$
d. $\frac{j + 3}{x - 4}$
*e. $(j + 3)\ (x - 4)$

Into which word phrase can the phrase $3r - 2$ be translated? 0117

a. The sum of 3 times r and 2
b. The product of 3r and 2
c. Two minus the product of 3 and r
d. The quotient of 3r and 2
* e. The difference of 3 times r and 2

Source: Dolciani - Algebra 1, Chapter 1.

THE STUDENT WILL ANALYZE SITUATIONS TO IDENTIFY THE HYPOTHESIS WHICH IS BEING TESTED IN A GIVEN SITUATION. 0097

A machine is devised to perform the following task: A finite number of prime numbers are inserted into the machine. The machine finds their product and adds one to the product. If the result is even, it is completely factored. If it is odd, nothing is done. Which of the following hypotheses is being tested or proved? 0213

a. There are infinitely many whole numbers.
b. There are infinitely many even numbers.
*c. There are infinitely many prime numbers.
d. There are infinitely many odd numbers.

THE PUPIL IS ABLE TO TRANSLATE A WORD PROBLEM INTO "WORKABLE" OR EQUATION FORM BY INDICATING THE CORRECT ALTERNATIVE FORM. 0100

Directions: Choose the letter of the equation that best expresses the process to be used in solving the problem.

Last week Mr. Edwards drove .5 as many miles as Mr. Hayes. Mr. Hayes drove 136.7 miles last week. How many miles did Mr. Edwards drive? 0232

a. $n = 136.7 + .5$
*b. $n = 136.7(.5)$
c. $n = \frac{136.7}{.5}$
d. $.5 = \frac{136.7}{n}$
e. none of these

Jane needs 2 1/2 lb. of salted nuts for a party. The nuts are sold 5 lb. cans. How many cans of nuts does Jane need to buy? 0233

a. $n = 2\ 1/2 \times 5/8$
b. $2\ 1/2n = 5/8$
*c. $n = 2\ 1/2\quad 5/8$
d. none of these

In 1950 there were about 500 students in Jupiter Junior High School. In 1960 there were 900 students. What is the percent of increase in school enrollment? 0234

a. $500 = \frac{n}{100}(900$

*b. $(900-500) = \frac{n}{100}(500)$

c. $900 = \frac{n}{100}(500)$

d. $\frac{500}{900} = n$

e. none of these

After Sue had gained 6 lb. she weighed 102 lb. What was the percent of increase in her weight? 0235

a. $6 = \frac{n}{100}(102)$

*b. $6 = \frac{n}{100}(102-6)$

c. $n = \frac{6}{100}(102)$

d. $6 = 102n$

e. none of these

What percent of 48 is 18? 0236

a. $n = \frac{18}{100}(48)$

b. $48 = \frac{n}{100}(18)$

*c. $18 = \frac{n}{100}948)$

d. $n = \frac{48}{100}(18)$

e. none of the above

In one state, the sales tax on automobiles was 4.5% of the selling price. At this rate how much sales tax did Mr. Morris have to pay on an automobile priced at $5400? 0237

a. $n = \frac{5400}{4.5}$
b. $n = 5400(4.5)$
c. $n = 5400(.45)$
d. $n = 5400(45)$
*e. none of the above

Mrs. James bought 5 bars of soap that was priced at 2 bars for 31¢. How much did she pay for the bars. 0238

*a. $\frac{5}{n} = \frac{2}{31}$
b. $\frac{n}{5} = \frac{2}{31}$
c. $10n = 31$
d. $5n = 31(2)$
e. none of the above

On a series of tests, Shirley received scores of 94, 98, 92, 85, and 90. What was her average score per test? 0239

a. $5n = 94 + 98 + 92 + 85 + 90$
b. $n = 1/5(94 + 98 + 92 + 85 + 90)$
c. $n = \frac{94 + 98 + 92 + 85 + 90}{5}$
*d. all of the above
e. none of the above

One winter, Chicago had 0.8 inches of snow in November and 8.0 inches of snow in December. What was the percent of increase in the amount of snowfall? 0240

a. $8.0 = \frac{n}{100}(8.0 - 0.8)$
*b. $(8.0 = 0.8) = \frac{n}{100}(0.8)$
c. $.8 = \frac{n}{100}(8.0 = 0.8)$
d. $8.0 = \frac{n}{100}(0.8)$
e. none of the above

Source: Seeing Through Math., Van engen., et al., Book 1.

THE STUDENT WILL APPLY HIS KNOWLEDGE OF THE RELATIONSHIP BETWEEN THE OPERATION OF ADDITION OF WHOLE NUMBERS AND OPERATIONS WITH SETS BY SELECTING A METHOD FOR SOLVING WORD PROBLEM. 0122

The number of boys on a certain football team called F is 25. The number of boys on a certain track team called T is 15. Six boys are members of both teams. Which of the following number sentences correctly describes a method for finding the number of boys that are members of only one of these teams? 0324

a. $n(F \cup T)$ = number of boys on only one team.
b. $n(F) + n(T)$ = number of boys on only one team.
c. $n(F) - n(F \cap T)$ = number of boys on only one team.
d. $n(T) - n(T \cap F)$ = number of boys on only one team.
*e. $n(F \cup T) - n(F \cap T)$ = number of boys on only one team.

A school band, called B, has 28 members. The school orchestra, called A, has 20 members. 15 students belong to both, band and orchestra. Use C to designate the set of students belonging to both band and orchestra. Which of the following number sentences correctly describes a method for finding the number of students who belong only to the band. 0325

*a. $n[B-(A \cap B)]$ = number of students in band only.
b. $n(B)$ = number of students in band only.
c. $n[B+(A \cap B)]$ = number of students in band only.
d. $n(B \cup A)$ = number of students in band only.
e. $n[B+(A \cup B)]$ = number of students in band only.

Source: Silver Burdett Co., Found. of Secondary School Math, Part I, pp. 19, 20, 21.

THE STUDENT WILL ANALYZE SEEMINGLY CONTRADICTORY STATEMENTS ABOUT SETS BY SELECTING THE APPROPRIATE REASON FOR THE SEEMING CONTRADICTION NOT BEING CONTRADICTORY. 0140

Given that 0377
n(A) + n(B) = n($A \cup B$) - n($A \cap B$) and
n(A) + n(B) = n($A \cup B$) + n($A \cup B$)
What conclusion can you arrive at regarding A B?

a. Impossible to get the same relationship when you add a set as when you subtract a set
b. Not enough information given to reach a conclusion
c. Either set A or set B or both sets have different elements in the first statement than in the second statement.
*d. The intersection of set A and set B is the empty set
e. Either the first or the second of the two statements above is false because they contradict each other

Given that 0378
n($P \cup Q$) = n(P) + n(Q) - n($P \cap Q$) and
n($P \cup Q$) = n(P) + n(Q) + n($P \cap Q$)
What must be true about the relationship of P and Q for both of these statements to be true?

a. $P \subset Q$
b. $Q \subset P$
c. $P = Q$
d. $P \cup Q = \emptyset$
*e. $P \cap \emptyset = \emptyset$

Source: Found. of Secondary School Math—Part I, Silver-Burdett, Ch. I.

THE STUDENT WILL ANALYZE A SUGGESTED NEW METHOD OF SOLUTION FOR A PROBLEM BY IDENTIFYING ERRORS. 0181

Directions: The following solutions are attempts to solve division problems using a new method.

	Problem	Results of Step 1	Results of Step 2	Results of Step 3	Results of Step 4
A)	1/2 ÷ 1/3 =	3/6 ÷ 2/6	= $\frac{2\quad 3}{6}$	= $\frac{1\ r\ 1}{6}$	= 1 1/6
B)	2/3 ÷ 1/4 =	$\frac{2 \div 1}{3 \div 4}$	= $\frac{2 \div 1}{12}$	= $\frac{1\ 1/2}{12}$	= 1/8
C)	1/3 ÷ 1/5 =	5/15 ÷ 3/15	= $\frac{5 \div 3}{15 \div 15}$	= 5 ÷ 3	= 1 2/3
D)	3/4 ÷ 2/5 =	15/20 ÷ 8/20	= 15/20 x 20/8	= 23/20	= 1 3/20

Which solution most likely expresses a method of solving division problems with rational numbers which could be called the common denominator method. 0523

a. A
b. B
*c. C
d. D

The probable advantage of this method over other methods is 0524

a. that there are fewer steps.
*b. that the problem becomes one of working with equal parts.
c. that adding and subtracting rational numbers involves using common denominators.
d. that fractions must have common denominators in order to be compared.

THE STUDENT WILL ANALYZE A PROBLEM BY ORGANIZING THE STEPS TO BE TAKEN IN THE SOLUTION. 0182

Directions: Below is a set of questions about a type of problem you have not solved before. However, if you use what you already know about fractions you can solve it. In what order would you find the results listed below?

$$\frac{7/8 - 2/3}{1/2 + 1/3}$$

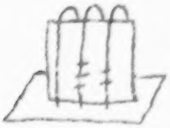
a. Common denominators 0525
b. reciprocal
c. sum and difference
d. Product

1. a,b,c,d
2. d,c,b,a
*3. a,c,b,d
4. d,b,a,c

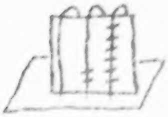
THE STUDENT WILL ANALYZE THE INFORMATION PROVIDED IN A SERIES OF DIAGRAMS BY WRITING A MATHEMATICAL STATEMENT FOR THESE DIAGRAMS. 0186

Directions: Select the statement which is associated with the series of diagrams below. The numbers in each equation are in the same number base.

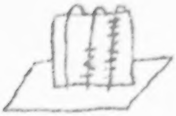
a. 0539



b.



c.



a. $32-26 = n$ in some number base
*b. $32 = n + 13$ in some number base
c. $26 = 13 + n$ in some number base
d. $26 + n = 32$ in some number base

THE STUDENT WILL TRANSLATE WORD SENTENCES INTO NUMBER SENTENCES AS EVIDENCED BY HIS ABILITY TO CORRECTLY MATCH A NUMBER SENTENCE WITH A WORD SENTENCE. 0189

Select the item which correctly matches a number sentence and word sentence. 0543

*a. If seven is subtracted from twenty-three the result is fifteen; $23 - 7 = 15$.
b. Seventeen is greater than ten; $10 > 17$.
c. Twelve is the product of three and four; $12 \div 4 = 3$.
d. Thirteen is not greater than 7: $13 \nless 7$.

THE STUDENT WILL DEMONSTRATE COMPREHENSION OF A STORY PROBLEM BY SELECTING FROM A LIST AN EQUATION WHICH WILL LEAD TO A CORRECT SOLUTION. 0203

George has caught 8 more fish than Fred. George gives Fred half his fish. Now, after the exchange, both boys have the same number of fish. Which equation below would help you find out how many fish each boy started with? 0560

a. $(x+8) - 1/2 = x$
b. $(x+8) \div 2 = x + 1/2$
*c. $(x+8) \div 2 = x + \frac{x + 8}{2}$
d. $(x+8) - \frac{(x + 8)}{2} = (x + 8) + \frac{(x + 8)}{2}$

THE STUDENT WILL ANALYZE THE REASONS FOR CERTAIN STEPS USED IN A PROBLEM BY SELECTING INAPPROPRIATE REASONS GIVEN IN A LIST OF STEPS. 0204

After reading the following method of changing a mixed numeral to an improper fraction, select from the list below the explanation that is not either logical, valid or completely true. 0561

1. $6\ 5/8$
2. $6 + 5/8$
3. $6\left(\frac{8}{8}\right) + 5/8$
4. $\frac{48}{8} + 5/8$
5. $\frac{48 + 5}{8}$
6. $\frac{53}{8}$

a. Step #2 is performed to separate the mixed # into a whole # and a proper fraction.
b. In step #3, multiply 6 x 8/8 to change the whole #6 into eighths.
c. Step #4 shows that 6 (8/8) is equivalent to 48/8.
*d. Step #5 shows that to add fractions, you add the numerators and then add the denominators.
e. Step #6 shows the answer.

THE STUDENT WILL ANALYZE A GEOMETRIC PROBLEM'S SOLUTION BY LOCATING MISAPPLICATIONS OF THE CONCEPTS INVOLVED. 0206

Given a pentagon ABCDE which of the following computations of the sum of the angles within the figure is not correct? 0565

* a. A triangle has 3 sides and 180°. Each side must require 60°. Therefore a pentagon must have 5 x 60° or 300°.
b. A triangle has a sum of 180° in it, a quadrilateral has a total of 360°. EAch extra side must add 180°, so a pentagon has 540°.
c. A pentagon can be thought of as 3 triangles next to each other. You know the sum of the angles in each triangle, so you could multiply this number by 3 to get the sum of the angles in the pentagon.
d. A pentagon could be thought of as a quadrilateral with a triangle next to it. If you know how many degrees in the sum of the angles of a quadrilateral and in the triangle, you could add these two together.

Source: Addison-Wesley
School Math I,
p. 275.

THE STUDENT WILL DEMONSTRATE ABILITY TO ANALYZE A STORY PROBLEM BY SELECTING FROM A LIST OF POSSIBLE QUESTIONS THOSE THAT CAN BE ANSWERED GIVEN A CERTAIN AMOUNT OF INFORMATION. 0211

George and Dick have a combined weight of 300 pounds and the sum of their ages is 30 years. Dick is twice as old as Sam, and Sam weighs half of what George weighs. When Stan, Sam's twin brother, gets on the scale with Dick, the scale registers 200 pounds. Stan is not 8 years old, but he weighs 120 pounds.

From the information above, which question below can not be answered? 0571

a. What is the sum of George's, Sam's, and Stan's ages?
*b. What is the sum of Dick's and Sam's ages?
c. What is the sum of George's, Sam's, and Stan's weights?
d. What is the sum of Dick's and Sam's weights?

THE STUDENT WILL DEMONSTRATE COMPREHENSION OF A STORY PROBLEM BY SELECTING AN APPROPRIATE EQUATION FOR THE PROBLEM FROM A LIST. 0212

A boy earns 50¢ per hour for mowing yards. and 60¢ per hour for raking leaves. If on one job it takes the boy twice as much time to rake as to mow, and the whole job takes 6 hours, how much does he earn? 0572

Which equation below would be useful in solving this problem?

a. $.50x + .60(2x) = .60x + .50(2x)$
*b. $.50x + .60(2x) = .50x + .60(6 - x)$
c. $.50(2x) + .60x = .50x + .60(6 - 2x)$
d. $.50(2x) + .60x = .50(6 - 2x) + .60(2x)$

THE STUDENT WILL ANALYZE A STORY PROBLEM SITUATION IN ORDER TO SELECT FROM A LIST A QUESTION WHICH CAN "NOT" BE ANSWERED FROM THE INFORMATION GIVEN. 0213

A box of detergent which sells for 45¢ and contains 5 ounces claims that it will wash 300 dishes. A second box which sells for 54¢ and contains 6 ounces claims that it will wash 360 dishes.

Which question below can not be answered from the above information? 0573

a. How much would 10 ounces of the first detergent plus 12 ounces of the second detergent cost?
b. Which detergent claims to be able to wash more dishes per ounce?
c. How many dishes could be washed with 1/2 box of the second detergent?
*d. How many dishes could you wash by mixing some of each detergent to make one cupful total?

THE STUDENT WILL DEMONSTRATE ANALYSIS OF A PROBLEM BY DISTINGUISHING BETWEEN NECESSARY AND SUPERFLUOUS THOUGHTS USED IN ITS SOLUTION. 0215

A girl started shopping with a certain amount of money. She spent half of her money in one store and $2.00 in a second store. If she had $4.00 left, how much did she start with? 0575

I. She spent 1/2 as much in the second store as she had left at the end.
II. The $4.00 she had left plus the $2.00 she spent in the second store equals half of what she started with.
III. She must have started with twice as much as she ended up with.
IV. The total amount she spent must be $4.00.

Which statement above is true and at the same time not relevant to the problem's solution.

*a. I
b. II
c. III
d. IV

THE STUDENT WILL ANALYZE A WORD PROBLEM AND SELECT INFORMATION IRRELEVANT TO THE PROBLEM'S SOLUTION FROM A LIST. 0216

A carpenter has to make a door that weighs less than 8 pounds. If the door is 3 times as tall as it is wide, and if its width is 2 1/2 feet, how many inches tall is the door? 0576

Choose from this list the information which would not be helpful in finding the answer to the problem above.

a. The height of the door.
b. The width of the door.
*c. The weight of the door.
d. The fact that 12 inches = 1 foot.

Bill said that he was twice as old as Tom, 1/3 as old as Joe, and one year older than Henry. Dave said he was 3 years older than Henry, and that he was not as old as Joe. If Henry's 11, how old is Joe? 0577

Which information below is not of any use in solving the problem?

*a. Bill is twice as old as Tom.
b. Bill is 1/3 as old as Joe.
c. Dave is 3 years older than Henry.
d. Bill is one year older than Henry.

THE STUDENT WILL ANALYZE A STORY PROBLEM AND SELECT FROM A LIST THE ADDITIONAL INFORMATION REQUIRED TO ANSWER THE QUESTION. 0218

Tom goes to the grocery store and buys 79¢ worth of vegetables at $1.58 per pound, some hamburger at 69¢ per pound, one and one half dozen oranges at 3/25¢, and a gallon of milk. How much did he pay for everything except the milk? 0586

Which additional information is required to answer this question?

a. The cost of the milk.
b. The number of pounds of vegetables he bought.
*c. The number of pounds of hamburger he bought.
d. The number of pounds of oranges he bought.

THE STUDENT WILL EVALUATE THE INFLUENCE OF CERTAIN CONDITIONS RELIED UPON IN A GIVEN PROBLEM-SOLUTION METHOD SEQUENCE BY SELECTING THE MOST INFLUENTIAL ITEM FROM A LIST. 0219

Two men were measuring some long rails. One man measured one rail, and another man measured another. In order to find the difference in lengths without putting them side by side, it would be most helpful to insure accuracy that they 0587

a. don't have one measure in centimeters and the other in millimeters.
b. use different basic units so they both don't make the same mistake.
c. each use the length of his forearm as a basic unit of measure.
d. both understand the original derivation of their basic unit and its initial determination.
*e. both use identical stan dards to measure with.

THE STUDENT WILL ANALYZE A WORD PROBLEM AND SELECT FROM A LIST THE INFORMATION IN THE STORY PROBLEM WHICH IS "NOT" ESSENTIAL TO ITS SOLUTION. 0220

Frank has less than 4 U. S. coins in his pocket. One of them is a nickel, and together they add up to 31¢. What are the coins? 0588

Which information in the problem is not needed to find the answer?

a. They add up to 31¢.
*b. One of them is a nickel.
c. Frank has less than 4 coins.

THE STUDENT WILL DEMONSTRATE COMPREHENSION OF A STORY PROBLEM BY IDENTIFYING FROM A LIST AN EQUATION WHICH WILL LEAD TO THE PROBLEM'S SOLUTION. 0223

A normal human heart beats on the average 72 times per minute. Approximately how many times does it beat during a 70 year lifespan? Which equation below would lead to a correct solution of this problem? 0591

a. $x = 72 \times 70$
b. $x = 72 \times 24 \times 365 \times 70$
*c. $x = 72 \times 60 \times 24 \times 365 \times 70$
d. $x = 72 \times 60 \times 60 \times 24 \times 365 \times 70$

Six years ago Sam was 6 and Joe was 18. What is the number by which you must multiply Sam's age to get Joe's age? Which equation below would lead to a correct solution of this problem? 0592

a. $x = 18 \div 6$
b. $x = 6 \div 18$
*c. $x = (18 + 6) \div (6 + 6)$
d. $x = (6 + 6) \div (18 + 6)$

THE STUDENT CAN ANALYZE WORD PROBLEMS INVOLVING PERCENT BY IDENTIFYING THE PERCENT OR NUMBER REQUIRED. 0247

15 children in a class of 120 achieved honor grades. 2/3 of the fifteen were girls. What percent of the class were the boys on the honor roll? 0649

a. 12%
*b. 4%
c. 2%
d. 40%

George made six mistakes on a math quiz which was 12% of the total questions. How many questions were there? 0650

a. 60
b. 72
c. 500
*d. 50

SIMPLIFICATION AND SUBSTITUTION

THE STUDENT WILL APPLY HIS KNOWLEDGE OF SIMPLIFYING PROCEDURES BY IDENTIFYING THE PROPERTY TO BE USED FIRST IN SIMPLIFYING AN EXPRESSION. 0008

The first property used in simplifying the expression $[2(x + 5)] + [4(x + 2)]$ would be

a. Addition facts
b. the Commutative Property of Addition
c. the Associative Property of Addition
*d. the Distributive Property of Multiplication over Addition
e. the Commutative Property of Multiplication

Source: Insight into School Mathematics, SRA, Book 2, p. 191.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF SIMPLIFYING AN EQUATION BY IDENTIFYING THE SOLUTION OF AN EQUATION. 0018

$6x\ (x + 4) - 6(x^2 - 3) = 66$ is equivalent to which of the following solution? 0023

a. $x = 1$
*b. $x = 2$
c. $x = 6$
d. $x = 11$
e. none of the above

Source: Insight into School Mathematics, SRA, Book [illegible], chapter 5.

THE STUDENT CAN DEMONSTRATE KNOWLEDGE OF SIMPLIFICATION RULES BY SIMPLIFYING ALGEBRAIC EXPRESSIONS. 0069

The first step in simplifying the expression $2\{6 + [9 - (4 \times 3) - 6]\}$ is to 0108

- a. subtract six from twelve
- b. multiply two times six
- *c. multiply four times three
- d. subtract twelve from nine
- e. none of these

The first step in simplifying algebraic expressions is to 0109

- a. remove brackets
- b. add and subtract
- c. simplify from left to right
- d. multiply and divide
- *e. simplify powers

Source: Dolciani - Algebra 1, Chapter 1.

THE PUPIL WILL SHOW HIS UNDERSTANDING OF GROUPING SYMBOLS AND HOW CHANGING THEM CHANGES THE MEANING OF A NUMBER SENTENCE BY FINDING TRUE NUMBER SENTENCES WHERE THERE IS GROUPING. 0169

Directions: Which of these replacements for n will make the following sentences true?

- a. $n = 4$
- b. $n = 5$
- c. $n = 6$
- d. $n = 7$
- e. $n = 8$

$13 - (n \cdot 3) + 1 = 2$	a	0506
$5n - (6 \cdot 6) + 4 + 0 = 3$	d	0507
$3(n + 2) = 18$	a	0508
$2n + (3 \cdot 4) - 1 = 21$	b	0509
$n - 3 = 2n - 9$	c	0510

Which of the following sentences is true? 0511

a. $24 - (4 \cdot 3) + 1 = 8$
b. $(24 - 4)(3 + 1) = 8$
*c. $24 - 4(3 + 1) = 8$
d. $24 - (4 \cdot 3 + 1) = 8$
e. $(24 - 4) \cdot 3 + 1 = 8$

THE STUDENT CAN DEMONSTRATE KNOWLEDGE OF NUMERICAL SUBSTITUTION RULES BY EVALUATING ALGEBRAIC EXPRESSIONS. 0070

Find the value of the following expression if $a = 1$, $b = 4$, $c = 2$ and $d = 5$. 0110

$$\frac{ab - c^2}{d + a^2}$$

a. $\frac{5}{3}$
*b. 0
c. $\frac{5}{18}$
d. $\frac{50}{3}$
e. 4

If the value of j is 3 and k is 4 what is the value of 0111

$$\frac{j^2 + (k^2 - 1)}{k^2 - j}$$

a. $\frac{23}{13}$
b. $\frac{14}{12}$
c. 2
d. $\frac{25}{12}$
*e. $\frac{24}{13}$

Source: Dolciani - Algebra 1, Chapter 1.

THE STUDENT CAN DEMONSTRATE KNOWLEDGE OF FORMULA SUBSTITUTION BY FINDING THE LEFT MEMBER OF A FORMULA GIVEN THE VALUES OF THE OTHER VARIABLES. 0074

The formula for finding the area of a trapezoid is $A = 1/2h(b_1 + b_2)$ What is A if $h = 10$, $b_1 = 2$, and $b_2 = 6$? 0118

a. 16
b. 36
*c. 40
d. 18
e. 120

What is the surface as of a rectangular prism with $h = .2$, $w = .4$, and $l = 2.2$? The formula for finding the surface area of a rectangular prism is $A = 2lw + 2\ lh + 2wh$ 0119

a. 1.316
b. 2.74
c. 2.66
*d. 2.8
e. 2.72

Source: Dolciani - Algebra 1, Chapter 1.

EQUATIONS

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO SOLVE EQUATIONS THAT HAVE POSITIVE AND NEGATIVE INTEGERS BY IDENTIFYING A SECOND EQUATION WHICH CAN BE USED TO SOLVE THE GIVEN EQUATION. 0029

Choose the equation which can be used to solve $n - {}^{-}7 = 16$ 0039

*a. $n = 16 + {}^{-}7$
b. $n = 16 + 7$
c. $n = 7 - 16$
d. $n = 7 - {}^{-}15$

Choose the equation which can be used to solve $n + 9 = {}^{-}5$ 0040

a. $n = {}^{-}5 + 9$
b. $n = 9 - {}^{-}5$
*c. $n = {}^{-}5 - 9$
d. $n = 9 - 5$

Choose the equation which can be used to solve $n \cdot {}^{-}32 = 17$ 0041

a. $n = {}^{-}32 \div 17$
b. $n = 17 \div 32$
c. $n = 32 \div {}^{-}17$
*d. $n = 17 \div {}^{-}32$

Choose the equation which can be used to solve $n \div 15\ {}^{-}7$ 0042

a. $n = {}^{-}7 \div 15$
b. $n = 15 \div {}^{-}7$
*c. $n = {}^{-}7 \cdot 15$
d. $n = 15 \cdot 7$

Source: School Mathematics II, chapter 2.

THE STUDENT CAN DEMONSTRATE AN UNDERSTANDING OF SOLUTION METHODS BY FINDING A SOLUTION SET OF AN EQUATION OR AN INEQUALITY OVER A GIVEN DOMAIN. 0072

What is the solution set of $-1 < x - 4 < 2$ if $x \in \{0, 3, 5\}$? 0114

a. $\{0, 3\}$
b. $\{5\}$
*c. $\{0, 3, 5\}$
d. $\{0\}$
e. $\emptyset$

If $x \in \{2, 4, 6, 8\}$, what is the solution set of the open sentence $2x - 2 = 4$? 0115

a. $\{2, 4\}$
b. $\{4, 6, 8\}$
c. $\{6\}$
*d. $\emptyset$
e. $\{2\}$

Source: Dolciani - Algebra 1, Chapter 1.

THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF THE PROCESS OF COMPLETING THE SQUARE BY SOLVING QUADRATIC EQUATIONS BY COMPLETING THE SQUARE. 0085

What number would be filled in the blank to make the polynomial $3x^2 + 7x +$ ______ a perfect square? 0151

a. $\frac{7}{3}$
b. $\frac{49}{9}$
c. $\frac{49}{81}$
*d. $\frac{49}{36}$
e. 49

Which expression is equivalent to $x^2 + \frac{7}{2}x + \frac{49}{16}$? 0152

a. $(x - \frac{7}{8})(x + \frac{7}{8})$
b. $(x - \frac{7}{8})^2$
c. $(x + \frac{7}{8})^2$
*d. $(x + \frac{7}{4})^2$
e. $(x - \frac{7}{4})(x + \frac{7}{4})$

Using the method of completing the square, what is the next step in the solution of the quadratic equation shown below? 0153

$$5x^2 + 7x - 3 = 0$$
$$x^2 + \frac{7}{5}x - \frac{3}{5} = 0$$
$$x^2 + \frac{7}{5}x = \frac{3}{5}$$

a. $x^2 + \frac{7}{5}x - \frac{3}{5} = 0$
b. $x^2 + \frac{7}{5}x + \frac{49}{25} = \frac{3}{5} + \frac{49}{25}$
*c. $x^2 + \frac{7}{5}x + \frac{49}{100} = \frac{3}{5} + \frac{49}{100}$
d. $x^2 + \frac{7}{5}x + \frac{49}{100} = \frac{3}{5}$
e. $x^2 = \frac{3}{5} - \frac{7}{5}x$

Find the step which contains a mistake 0154

$4x^2 - 6x - 2 = 0$
$x^2 - \frac{3}{2}x - \frac{1}{2} = 0$ step 1
$x^2 - \frac{3}{2}x = \frac{1}{2}$ step 2
$x^2 - \frac{3}{2}x + \frac{9}{16} = \frac{1}{2}$ step 3
$\left(x - \frac{3}{4}\right)^2 = \frac{1}{2}$ step 4
$x - \frac{3}{4} = \frac{-1}{\sqrt{2}}$ or $x - \frac{3}{4} = \frac{1}{\sqrt{2}}$ step 5

a. step 1
b. step 2
*c. step 3
d. step 4
e. step 5

Which step follows from $\left(x + \frac{3}{7}\right)^2 = \frac{15}{9}$? 0155

*a. $x + \frac{3}{7} = \frac{\sqrt{15}}{3}$ or $x + \frac{3}{7} = -\frac{\sqrt{15}}{3}$

b. $x + \frac{\sqrt{3}}{7} = \frac{\sqrt{15}}{3}$ or $x - \frac{\sqrt{3}}{7} = \frac{\sqrt{15}}{3}$

c. $x + \frac{9}{49} = \frac{225}{81}$ or $x + \frac{9}{49} = \frac{225}{81}$

d. $x + \frac{3}{7} = -\frac{\sqrt{15}}{3}$

e. $x + \frac{3}{7} = \frac{5\sqrt{3}}{3}$

The disjunction $x - \frac{3}{8} = \frac{2\sqrt{5}}{4}$ or $x - \frac{3}{8} = -\frac{2\sqrt{5}}{4}$ is equivalent to 0156

a. $x = \frac{2\sqrt{5}}{4} + \frac{3}{8}$ or $x = \frac{2\sqrt{5}}{4} - \frac{3}{8}$

*b. $x = \frac{3 - 4\sqrt{5}}{8}$ or $x = \frac{3 + 4\sqrt{5}}{8}$

c. $x = \frac{4\sqrt{5} + 3}{8}$ or $x = \frac{4\sqrt{5} - 3}{8}$

d. $x = \frac{3}{8} - \frac{2\sqrt{5}}{4}$

e. none of the above

THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF THE QUADRATIC FORMULA BY SOLVING QUADRATIC EQUATIONS USING THE QUADRATIC FORMULA. 0086

The equation $ax^2 + bx + c = 0$ is equivalent to 0157

a. $x = \frac{\pm b - \sqrt{b^2 - 4ac}}{2a}$

*b. $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

c. $x = \frac{-b \pm \sqrt{a^2 - 4bc}}{2a}$

d. $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{ab}$

e. $x = \frac{-a \pm \sqrt{b^2 - 4ac}}{2a}$

If $b^2 - 4ac < 0$, how many real number solutions does the equation have? 0158

a. three
b. two
*c. none
d. one
e. four

If $b^2 - 4ac = 0$ the equation has 0159

*a. one real number solution
b. no real number solutions
c. two real number solutions
d. three real number solutions
e. more than three real number solutions

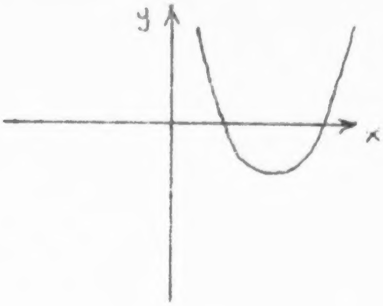
If $b^2 - 4ac > 0$, how many real number solutions does the equation have? 0160

a. none
b. three
c. one
d. more than three
*e. two

The discriminant of the equation $2x^2 - 3x + 5 = 0$ is 0161

a. 4
*b. −31
c. 50
d. −56
e. 1

What can be said about the discriminant of the quadratic equation whose graph is shown below? 0162



a. it is equal to zero
b. it is less than zero
*c. it is greater than zero
d. it is greater than or equal to zero
e. it is less than or equal to zero

In the equation $\frac{1}{8} - 2x = \frac{x^2}{3}$ the values of a, b, and c are: 0163

a. $-2, \frac{1}{8}, 3$
b. $\frac{1}{8}, -2, \frac{1}{3}$
c. $\frac{1}{3}, -2, \frac{1}{8}$
*d. $-\frac{1}{3}, -2, \frac{1}{8}$
e. $-\frac{1}{3}, 2, \frac{1}{8}$

The first step in the solution of $3x^2 - 2x - 1 = 0$ by using the quadratic formula is 0164

a. $x = \frac{\pm(-2)^2 - \sqrt{(-2)^2 - 4 \cdot 3 \cdot (-1)}}{2 \cdot 3}$
b. $x = \frac{-3 \pm \sqrt{(-2)^2 - 4 \cdot 3 \cdot (-1)}}{2 \cdot (-2)}$
*c. $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4 \cdot 3 (-1)}}{2 \cdot 3}$
d. $x = \frac{(-2)^2 \pm \sqrt{(-2)^2 - 4 \cdot 3 (-2)}}{2 \cdot 3}$

If $x = \dfrac{-(-4) \pm \sqrt{(-4)^2 - 4 \cdot (1) \cdot (2)}}{2 \cdot 1}$ then the solution to the equation is 0165

a. $x = x = -6$ or $x = 2$

*b. $x = 6$ or $x = -2$

c. $x = 2 + \frac{1}{2}\sqrt{10}$ or $x = 2 - \frac{1}{2}\sqrt{10}$

d. $x = 2 + \sqrt{6}$ or $x = 2 - \sqrt{6}$

e. $x = -2 + \sqrt{6}$ or $x = -2 + \sqrt{6}$

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF SLOPE-INTERCEPT FORM BY IDENTIFYING A LINEAR EQUATION IN SLOPE-INTERCEPT FORM. 0089

Which equation is in slope-intercept form? 0168

a. $2y = 3x - 4$

*b. $y = -2x + 1/2$

c. $3x + 2y - 4 = 0$

d. $x = -3y - 2$

e. $4x + 3y = 0$

The equation $3x + 6y = 3$ can be written in slope-intercept form as 0169

a. $6y = 3 - 2x$

b. $x = -3y + \frac{3}{2}$

*c. $y = \frac{-1}{3}x + \frac{1}{2}$

d. $2x = -6y + 3$

e. $y = \frac{1}{3}x - \frac{1}{2}$

Which of the following is the slope-intercept form of $Ax + By = C$ 0170

a. $By = C - Ax$
b. $x = \frac{B}{A} y + \frac{C}{a}$
c. $c = Ax + By$
d. $Ax = C - By$
*e. $y = \frac{A}{B}x + \frac{C}{B}$

GIVEN THE SLOPE-INTERCEPT FORM OF A LINEAR EQUATION, THE STUDENT DEMONSTRATES UNDERSTANDING OF SLOPE-INTERCEPT BY IDENTIFYING THE SLOPE AND THE Y-INTERCEPT. 0090

The slope of the equation $y = -2x + 4$ is 0171

a. 1/2
*b. -2
c. 4
d. -4
e. 1/4

The y-intercept of the equation $y = 1/2x - 2$ is 0172

a. -1/2
b. 1/2
c. 2
*d. -2

THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF SOLUTION METHODS TO SOLVE EQUATIONS BY MEANS OF EQUIVALENT EQUATIONS AND THE TRANSFORMATIONS USED. 0091

Equivalent equations always have the same __________. 0173

a. coefficients
*b. solution set
c. number of terms
d. variable

$.6x = 4.2$ is equivalent to ______. 0174

*a. $6x = 42$
b. $6\ x = .42$
c. $\frac{6}{10}x = 42$
d. $x = .7$

$m - 3 = -1$ is equivalent to ______. 0175

a. $m = -4$
b. $m - 4 = 0$
c. $m = 4$
*d. $m = 2$

The ______ property allows use to transform $2\ (x+3) = 8$ to $2x + 6 = 8$. 0176

a. associative
*b. distributive
c. commutative
d. multiplication

$-4 + 6M = \frac{5}{3}$ and ______ are equivalent equations. 0177

*a. $\frac{1}{6}\ (6m) = \frac{1}{6}\ (\frac{17}{3})$
b. $\frac{1}{6}\ (6m) = \frac{4}{3} + 4$
c. $6m = \frac{1}{6}\ (\frac{4}{3} + -4)$
d. $\frac{1}{6}\ m = \frac{3}{5} - \frac{1}{4}$

______ is the solution set of $^{-}7m = 32$. 0178

a. $m : m = 39$
b. $m : m = 25$
*c. $m : m = \frac{-32}{7}$
d. $m : m = \frac{32}{7}$

$2x + 8x = {}^{-}8.2$ and $x = {}^{-}.82$ are equivalent because of the ______. 0179

a. distributive property.
b. addition property of equality.
c. multiplication property of equality.
*d. both a and c.

$x : x \; {}^{-}.326$ contains ________ as a member. 0180

a. $-.3$
b. $-.2$
*c. -9
d. 0

INEQUALITIES

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF INEQUALITIES BY IDENTIFYING THE SOLUTION SET OF AN INEQUALITY. 000

Given U = {directed numbers}. Find the solution set of the inequality $8 > {}^{-}2x + 7$. 001

- *a. $\{x \mid x > {}^{-}\frac{1}{2}\}$
- b. $\{x \mid x < \frac{1}{2}\}$
- c. $\{x \mid x > \frac{15}{2}\}$
- d. $\{x \mid x < \frac{-15}{2}\}$
- e. None of the above

Source: Insight into School Mathematics, SRA, Book 2, p. 191.

THE STUDENT CAN COMPREHEND THE SYMBOLS FOR EQUALITIES AND INEQUALITIES AND SIGNIFY THIS BY SELECTING THE TRUE OR FALSE NUMBER SENTENCE INCORPORATING THE SYMBOLS. 025

Which of the following number sentences is true? 066

- *a. $2 < 5$
- b. $2 > 5$
- c. $2 = 5$
- d. $2 \not< 5$

Which of the following number sentences is false? 066

- a. $6 \not> 7$
- b. $6 \neq 7$
- c. $6 < 7$
- *d. $6 > 7$

FUNCTIONS AND RELATIONS

THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF RELATIONS BY CHOOSING THE MOST APPROPRIATE RELATIONS IN PROBLEM SOLVING SITUATIONS. 0096

Directions: Below is a list of relations. The exercises following the list are related to one of the relations. Choose the most appropriate relation for each exercise.

Relations:

a. $y = kx$
b. $y = kx^2$
c. $y = \frac{k}{k}$
d. $y = \frac{k}{x^2}$

Exercise:

x	-5	-3	1	2	4
y	$-\frac{1}{5}$	$-\frac{1}{3}$	1	$\frac{1}{2}$	$\frac{1}{4}$

a. $y = kx$ 0210
b. $y = kx^2$
*c. $y = \frac{k}{x}$
d. $y = \frac{k}{x^2}$

Exercise:

x	-5	-3	-2	1	4
y	-125	-45	-20	-5	-80

a. $y = kx$ 0211
*b. $y = kx^2$
c. $y = \frac{k}{x}$
d. $y = \frac{k}{x^2}$

Source: Seeing Through Math, Van Engen, et al, Chap. 13, pp. 289, 313.

Exercise:

x	-8	-4	1	4	8
y	2	1	$-\frac{1}{4}$	-1	-2

*a. $y = kx$ 0212
b. $y = kx^2$
c. $y = \frac{k}{x}$
d. $y = \frac{k}{x^2}$

Source: Seeing Through Math, Van Engen, et al, chap. 13, pp. 289, 313.

THE STUDENT WILL BE ABLE TO RECOGNIZE APPLICATION OF RELATIONS OF DIRECT AND INVERSE VARIATION BY SELECTING THE VARIATION FOR A GIVEN APPLICATION. 0102

A carpenter can build 10 ft. of fence in one hour. At this rate, how many feet of fence can he build in 8 hours? 0247

*a. $y = kx$
b. $y = kx^2$
c. $y = \frac{k}{x}$
d. $y = \frac{k}{x^2}$

The distance a car travels after the brakes are applied varies directly as the square of the speed of the car. 0248

a. $y = kx$
*b. $y = kx^2$
c. $y = \frac{k}{x}$
d. $y = \frac{k}{x^2}$

The electrical resistance of wire varies inversely as the square of the diameter of the wire. 0249

a. $y = kx$

b. $y = kx^2$

c. $y = \frac{k}{x}$

*d. $y = \frac{k}{x^2}$

A clock gains 2 minutes in 10 hours. At this rate how many minutes does the clock gain in 72 hours? 0250

*a. $y = kx$

b. $y = kx^2$

c. $y = \frac{k}{x}$

d. $y = \frac{k}{x^2}$

Two triangles have a common base. One altitude is twice the other. Compare the areas. 0251

*a. $y = kx$

b. $y = kx^2$

c. $y = \frac{k}{x}$

d. $y = \frac{k}{x^2}$

The distance traveled by a falling object, starting from rest, varies directly as the square of the time traveled. A rock falling from a cliff traveled 400 ft. in the first 5 seconds that it fell. How many feet did the rock travel in the first 10 seconds? 0252

a. $y = kx$

*b. $y = kx^2$

c. $y = \frac{k}{x}$

d. $y = \frac{k}{x^2}$

The formula d = r x t is an application of which relation named? 0253

*a. $y = kx$

b. $y = kx^2$

c. $y = \frac{k}{x}$

d. $y = \frac{k}{x^2}$

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE GENERAL DEFINITION OF FUNCTION AS EVIDENCED BY HIS ABILITY TO IDENTIFY SETS OF ORDERED PAIRS WHICH ARE "NOT" FUNCTIONS. 0196

Select the set of ordered pairs which is not a function relation. 0553

a. $M = \{(1,1), (2,2), (3,3), (4,4), (5,5)\}$

*b. $N = \{(1,1), (1,2), (2,1)\}$

c. $O = \{(1,1), (2,4), (3,9), (4,16), (5,25)\}$

d. $P = \{(1,1), (2,1), (3,2), (4,2)\}$

THE STUDENT WILL ANALYZE A TABLE OF DATA AS EVIDENCED BY HIS ABILITY TO IDENTIFY SETS WHICH ARE RELATIONS DERIVED FROM THE TABLE. 0197

Table: The Adams Family

Names	Age	Weight	Height
Dad = D	42	170	6'0"
Mom = M	40	123	5'6"
Bob = B	19	135	5'10"
Ted = T	17	145	5'4"
Susan = S	15	107	5'0"

Select the set which completely defines a relation on the Adams family. 0554

*a. { (B,T), (T,B), (B,S), (T,S) }

b. { (B,D), (B,M), (T,D), (T,M), (S,D), (D,M) }

c. { (D,M), (D,B), (D,T), (D,S), (M,S), (B,M), (B,S), (T,M), (T,B), (T,S), (S,D) }

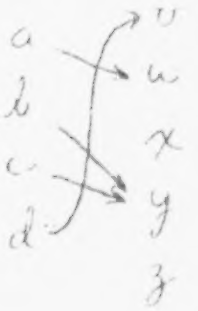
d. { (D,M), (D,B), (D,T), (D,S), (M,B), (M,T), (M,S), (B,T), (B,S), (T,S), (S,T) }

Source: NCTM 30th yearbook.

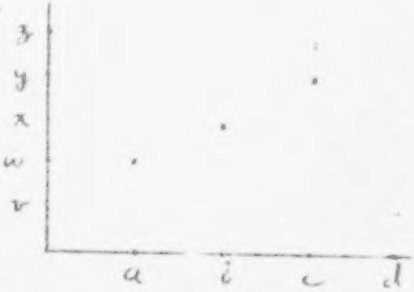
THE STUDENT WILL ANALYZE DIFFERENT REPRESENTATIONS OF SETS OF ORDERED PAIRS BY SELECTING THE REPRESENTATION WHICH ILLUSTRATES A FUNCTION RELATION. 0198

Select the relation which is a function relation. 0555

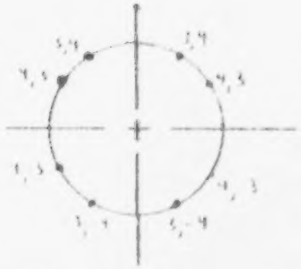
* a.



b.



c.



d. The set of letters of the alphabet into the set of states.

THE STUDENT WILL ANALYZE NUMBER RELATIONSHIPS BY SELECTING FROM A LIST A NUMBER PAIR THAT EXHIBITS THE SAME RELATIONSHIP AS A GIVEN SET OF NUMBER PAIRS. 0205

Given the following set of pairs of numbers, find the pair below that would also be a member of this set: 0562

(12,7), (50,26), (94,48),...

a. (30,15)
b. (41,22)
c. (98,47)
*d. (112, 57)

Which ordered triple below is a member of this set: 0563

(10,25,15), (30,75,45), (4,10,6)...?

a. (1,3,2)
b. (16,40,25)
*c. (90,215,135)
d. (25,75,50

Which ordered pair in the list below is a member of this set: 0564

(10,4), (15,5), (25,7), (35,9)...?

a. (100,21)
b. (40,11)
*c. (50, 14)
d. (65, 17)

THE STUDENT WILL ANALYZE A SET OF PAIRS OF NUMBERS BY DETERMINING WHETHER OR NOT THE SET IS A SET OF ORDERED PAIRS. 0178

Which set of pairs of numbers is a set of ordered pairs? 0520

a. 3,8;4,15;5,24;6,36;7,48;
b. 2,6;3,12;4,20;5,32;6,40;
c. 2,10;3,11;4,100;5,111;6,1000
*d. 1,1;2,4;3,27;4,256;5,625

MEASUREMENT

THE STUDENT WILL USE HIS UNDERSTANDING OF MEASUREMENT BY SELECTING AN APPROPRIATE WAY TO KEEP A RECORD OF SOME PHYSICAL CHANGE. 0172

Given the list below which method would be most acceptable for keeping a record of your height over the next two years. Assume you will record an observation every month. 0514

a. By recording how high you can jump
b. By keeping a record of your weight
c. By recording the length of your shadow
*d. By comparing your height to your father's height

THE STUDENT WILL APPLY WHAT HE KNOWS ABOUT MEASUREMENT BY DECIDING WHETHER OR NOT SOMETHING CAN BE USED AS A STANDARD UNIT OF MEASUREMENT IN A GIVEN SITUATION. 0170

If there were no clocks or any other mechanical method of measuring time how would you measure time? 0512

a. Count the sunny days
b. Count the rain storms
c. Count the birds flying over head
*d. Count the nights

THE STUDENT CAN ANALYZE PROBLEMS WHICH INVOLVE THE UNITS OF BOTH THE ENGLISH AND METRIC SYSTEMS BY IDENTIFYING THE CORRECT RELATIONSHIP OF RESPECTIVE UNITS. 0003

The thickness of a dime is approximately equal to 0004

*a. 1 millimeter
b. 1 centimeter
c. 1 inch
d. 1 decimeter
e. 1/2 inch

Two pounds is approximately equal to 0005

a. 2 kilograms
b. 1 gram
c. 100 ounces
d. 2 centigrams
*e. 1 kilogram

Source: Insight into School Mathematics, Book 2, SRA, p. 42.

THE STUDENT WILL BE ABLE TO USE HIS KNOWLEDGE OF THE CENTER OF ROTATION BY IDENTIFYING THE SOLUTION TO THE PROBLEM INVOLVING THIS IDEA. 0011

When Billy Williams, of the Chicago Cubs, swings a baseball bat the center of rotation is: 0014

a. at the barrel, or "fat", of the bat
b. at the handle of the bat
c. very near his feet
*d. very near his chest
e. none of the above

Source: Insight into School Mathematics, SRA, Book 2, p. 105.

THE STUDENT WILL ANALYZE A TABLE OF DATA CONCERNING AREA AND PERIMETER OF A SIMPLE CLOSED FIGURE ON THE GEO-BOARD AS EVIDENCED BY HIS ABILITY TO IDENTIFY THE AREA GIVEN INFORMATION ABOUT THE PERIMETER. 0200

Given the table below predict the area of a simple closed curve on the geo-board if the number of nails used is 5 and the number of unused nails is 3. The area is 0557

a. 5 1/2 units.
b. 5 units.
*c. 4 1/2 units.
d. 4 units.

(a) All nails used		(b) One nail inside not used		(c) Two nails inside not used	
X	Y	X	Y	X	Y
4	1	4	2	4	3
5	1 1/2	5	2 1/2	5	3 1/2
6	2	6	3	6	4
7	2 1/2	7	3 1/2	7	4 1/2

X = number of nails touched in the perimeter.
Y = area

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF THE RELATIONSHIP BETWEEN A RADIUS OF A CIRCLE AND ITS AREA BY IDENTIFYING WHAT HAPPENS TO THE AREA WHEN THE RADIUS IS TRIPLED. 0051

When the radius of a circle is tripled, the area of the circle 0076

a. is tripled
b. remains the same
c. becomes six times as great
d. becomes smaller
*e. none of the above

Source: Advancing in Mathematics, part 7.

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF THE MEANING OF PI BY IDENTIFYING THE NUMBER OF RADII NEEDED TO APPROXIMATELY EQUAL THE CIRCUMFERENCE. 0055

In any circle, approximately how many radii are needed to equal one circumference? 0080

a. 2
b. 3
c. 4
d. 5
*e. 6

Source: S.R.A. Advancing in Mathematics, part 7.

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE FORMULA FOR FINDING THE VOLUME OF A SPHERE BY IDENTIFYING THE FORMULA. 0010

The formula for finding the volume of a sphere is V = 0013

*a. $4/3\pi r^3$
b. $3/4\pi r^3$
c. $4/3\pi r^2$
d. $3/4\pi r^2$
e. none of the above

Source: Insight into School Mathematics, SRA, Book 2, p. 322.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF VOLUME AS BEING 3-DIMENSIONAL BY IDENTIFYING A FICTICIOUS FORMULA WHICH POSSESSES EXACTLY 3 DIMENSIONS. 0058

Which of the following might possibly be a formula used to find the volume of something? 0086

a. $V = \frac{b \times h}{2}$
*b. $V = \frac{\pi \cdot r^2 \cdot h}{5}$
c. $V = \frac{4 \cdot \pi \cdot r^3 \cdot h}{3}$
d. $V = l \times w \times 3$

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF THE RELATIONSHIP BETWEEN THE RADIUS OF A SPHERE AND ITS VOLUME BY IDENTIFYING WHAT HAPPENS TO THE VOLUME WHEN THE RADIUS IS DOUBLED. 0052

When the radius of a sphere is doubled, the volume of the sphere 0077

a. remains the same
b. is doubled
c. becomes four times as great
d. becomes six times as great
*e. becomes eight times as great

Source: S.R.A. Advancing in Mathematics, part 7.

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF THE RELATIONSHIP BETWEEN THE RADIUS AND HEIGHT OF A CYLINDER AND ITS VOLUME BY IDENTIFYING WHAT HAPPENS TO THE VOLUME WHEN THE RADIUS AND HEIGHT ARE BOTH TRIPLED. 0053

When the radius and height of a cylinder are both tripled, the volume of the cylinder 0078

a. is tripled
b. becomes six times as great
c. becomes nine times as great
d. becomes eighteen times as great
*e. becomes twenty-seven times as great

Source: S.R.A. Advancing in Mathematics, part 7.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE RELATIONSHIP BETWEEN THE VOLUMES OF A CYLINDER AND A CONE WITH CONGRUENT BASES AND ALTITUDES BY IDENTIFYING BY WHAT NUMBER HE WOULD HAVE TO DIVIDE THE VOLUME OF THE CYLINDER TO GET THE VOLUME OF THE CONE. 0054

Suppose a cylinder and a cone have congruent bases and congruent altitudes. If you knew the volume of the cylinder, you could calculate the volume of the cone by dividing the volume of the cylinder by 0079

a. 2
b. 2 1/2
*c. 3
d. 4
e. none of the above

Source: S.R.A. Advancing in Mathematics, part 7.

POLYGONS

THE STUDENT WILL BE ABLE TO APPLY HIS KNOWLEDGE OF REGULAR POLYGONS AND ANGLE MEASURE BY IDENTIFYING THE SOLUTION TO A PROBLEM INVOLVING THESE CONCEPTS. 0014

The perimeter of a regular polygon is 60 inches. If one of the central angles has a measure of 90°, what is the length of one of the sides? 0017

- a. 5 inches
- b. 10 inches
- *c. 15 inches
- d. 30 inches
- e. impossible to determine

One of the central angles of a regular polygon has a measure of 36°. If the length of one of the sides is 8 inches, what is the perimeter of the polygon? 0018

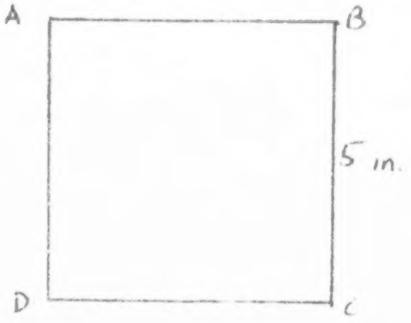
- a. impossible to determine
- b. 32 inches
- c. 40 inches
- *d. 80 inches
- e. none of the above

Source: Insight into School Mathematics, SRA, Book 2, page 120.

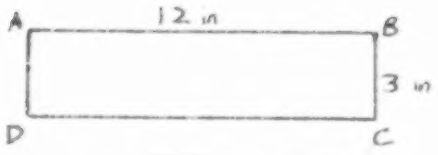
THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO CALCULATE THE PERIMETER OF A POLYGON BY IDENTIFYING THE PERIMETER OF A GIVEN POLYGON. 0049

The perimeter of square ABCD is 0071

- a. 5 in.
- b. 10 in.
- *c. 20 in.
- d. 25 in.
- e. none of the above



The perimeter of rectangle ABCD is 0072



a. 15 in.
b. 36 in.
c. 28 in.
d. 31 in.
*e. none of the above

The perimeter of a regular pentagon with one side 2 inches long is 0073

*a. 10 in.
b. 32 in.
c. 25 in.
d. 12 in.
e. none of the above

The perimeter of a regular octagon with one side 3 inches long is 0074

a. 1 ft.
b. 15 in.
c. 18 in.
*d. 2 ft.
e. none of the above

Source: S.R.A. Advancing in Mathematics, part 7.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE MEANING OF THE WORD ISOSCELES BY IDENTIFYING ITS DEFINITION. 0050

An isosceles triangle is a triangle which has 0075

a. two sides congruent but no two angles congruent.
b. three sides congruent and three angles congruent.
*c. two sides congruent and two angles congruent.
d. three sides of different lengths but two angles congruent.

Source: S.R.A. Advancing in Mathematics, part 7.

POLYNOMIALS

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF SIMILIARITY BY DETERMINING IF TWO MONOMIALS ARE SIMILAR. 0077

Which pair of monomials are similar? 0129

*a. $3x^2y^4$, $-7x^2y^4$
b. $2ab^2$, $5\ a^2b$
c. $4\ xy$, $-4x^2\ y$
d. $6\ a\ b\ c$, $6\ a\ b$
e. $-\ 3\ a$, $4\ b$

Which monomial is similar to $3\ x^2\ t^4$? 0130

*a. $a\ -2\ x^2\ y^4$
b. $5\ x\ y^4$
c. $12\ x\ y$
d. $10\ abc^2$
e. xy

Source: Dolciani, Algebra 1, Chapter 2.

THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF SIMPLIFICATION RULES BY DETERMINING IF A POLYNOMIAL IS IN SIMPLE FORM. 0078

Which of the polynomials is in simple form? 0131

a. $3x^2y + 7xy + 5x^2y$
b. $2x^2 + 3y^2 + 2 + 3$
*c. $2x^4y^3 - 5x^3y^3 + 6x^2y^2 + 7\ xy$
d. $-\ 3 + x^2y + 4 + x^3y^2$
e. $x^2 + 3ab - x^2 + 4a^2b$

A polynomial is in simple form when 0132

a. it has three or fewer terms
b. its degree is less than 3
c. no two of its terms have like coefficients
*d. no two of its terms are similar
e. none of the above

Source: Dolciani, Algebra 1, Chapter 2.

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF THE DISTRIBUTIVE AXIOM AND THE SUBSTITUTION PRINCIPLE TO SIMPLIFY A GIVEN POLYNOMIAL. 0079

The distributive axiom enables you to write $2x^2 + 7x^2 - 3x^2$ as: 0133

a. $(2 + 7 - 3)\ x^2 \cdot x^2 \cdot x^2$
b. $-3x^2 + 7x^2 + 2x^2$
c. $(2x^2 + 7x^2) - 3x^2$
*d. $(2 + 7 - 3)x^2$
e. none of the above

What principle or axiom enables you to write $(3 + 5)x^2 + (7 + 9)y^2$ as $8x^2 + 16y^2$? 0134

a. distributive axiom
*b. substitution principle
c. commutative axiom
d. closure axiom for addition
e. associative axiom

Source: Dolciani, Algebra 1, Chapter 2.

EXPONENTS

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE EXPONENT ZERO, BY SELECTING THE EXPRESSION WHICH IS EQUIVALENT TO A GIVEN VALUE. 0016

Assuming $x \neq 0$, which of the following expression is equal to 10? 0020

a. $10x^1$
*b. $10x^0$
c. $9x + 1$
d. $10x$
e. none of the above

Source: Insight into School Mathematics, SRA, Book 2, page 185.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF POWERS BY RECOGNIZING ANOTHER NAME FOR A NUMBER. 0019

The second power of 3 is 0024

a. $\sqrt{3}$
b. 6
*c. 9
d. 2^3
e. 3/2

8 is the third power of 0025

a. 24
*b. 2
c. $2\frac{2}{3}$
d. 512
e. 5

Source: Advancing in Mathematics, SRA, part 12.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF POWERS BY IDENTIFYING WHICH NUMBER IS "NOT" THE SQUARE OF AN INTEGER 0020

Which of the following is NOT the square of an integer? 0026

a. 81
b. 9^3
c. 64
d. (9 + 16)
*e. (900 + 100)

Source: Advancing in Mathematics, SRA, part 12.

THE STUDENT WILL BE ABLE TO RENAME NUMBERS IN EXPONENTIAL FORM BY IDENTIFYING THE CORRECT FORM. 0024

Which of the following statements is FALSE? 0032

a. $10^2 = 100$
b. $4^3 = 4^2 \cdot 4$
*c. $7^2 = 14$
d. $9^2 = 81$
e. $2^4 = 4^2$

Which of the following statements is TRUE? 0033

a. $4^6 = 6^4$
b. $7^1 = 7 + 1$
c. $4^0 = 0$
*d. $2^5 \div 2^0 = 32$
e. $5^3 = 15$

Source: Mathematics II, p. 6-14.

THE STUDENT WILL ANALYZE THE RELATIONSHIP BETWEEN EXPONENTIAL NOTATION AND MULTIPLICATION OF THE POWERS OF A BASE, DEVISE A RULE, AND APPLY THIS RULE BY FINDING THE PRODUCT OF TWO NUMBERS IN EXPONENTIAL FORM. 0150

We have seen that $2^2 = 4$ and $2^3 = 8$ and $2^5 = 32$ and also that $3^2 = 9$ and $3^4 = 81$, and $9 \times 81 = 729 = 3^6$.

Which of the following is NOT a true statement? 0427

a. $4^1 \times 4^3 = 4 \times 64 = 256 = 4^4$
b. $7^0 \times 7^2 = 49 = 7^2$
c. $5^1 \times 5^1 = 25$
*d. $6^3 \times 6^1 = 6^3$
e. $2^8 \times 2^1 = 512$

Which of the following is NOT a true statement? 0428

a. $10^3 \times 10^4 = (10 \times 10 \times 10) \times (10 \times 10 \times 10 \times 10)$
b. $10^7 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10{,}000{,}000$
c. $10^3 \times 10^2 \times 10^3 = 100{,}000{,}000 = 10^8$
*d. $10^a \times 10^b = 10^{(a \times b)}$
e. $10^a + 10^b = 10^{(a + b)}$

Source: Found. of Secondary School Math—Part I, pp. 31,32.
Silver-Burdett.

THE STUDENT WILL ANALYZE THE RELATIONSHIP BETWEEN THE POWER OF TEN AND ITS DECIMAL NOTATION, DEVISE A RULE, AND APPLY THIS RULE BY WRITING ANY POSITIVE POWER OF TEN IN EXPONENTIAL AND/OR DECIMAL FORM. 0151

We know that:

$10^1 = 10$ and

$10^2 = 10 \times 10$ and

$10^3 = 10 \times 10 \times 10$ and

$10^4 = 10 \times 10 \times 10 \times 10$ and

$10^5 = 10 \times 10 \times 10 \times 10 \times 10$

Then, what is the decimal notation for 10^{12}? 0429

a. 100,000,000,000
*b. 1,000,000,000,000
c. $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$
d. twelve tens
e. ten to the twelfth power

What is the exponent form of 10,000,000,000? 0430

a. 10^9
b. $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$
*c. 10^{10}
d. $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$
e. 1^{10}

Source: Found. of Secondary School Math—Part I, pp 31-32, Silver-Burdett.

THE STUDENT WILL ANALYZE EXPONENTIAL FORMS OF NUMBERS BY RECOGNIZING THE RULE FOR THE RELATIONSHIP BETWEEN TWO NUMBERS IF THE EXPONENTIAL FORM OF ONE NUMBER HAS THE BASE AND EXPONENT REVERSED IN THE EXPONENTIAL FORM FOR ANOTHER NUMBER. 0154

Which of the following statements are true 0435

1. 2^4 and 4^2 name the same number
2. 2^3 and 3^2 name the same number
3. 3^4 and 4^3 name the same number
4. If a and b are whole numbers, a^b and b^a name the same numbers for all values of a and b
5. If a and b are whole, numbers, a^b and b^a name the same numbers for some values of a and b.
6. If a and b are whole numbers, a^b and b^a will never name the same number for any value of a and b.

a. 1, 2, 3, and 4
b. 2, 3 and 5
c. 1, 2, 3 and 6
d. 2 and 6
*e. 1 and 5

Source: Found. of Secondary School Math—Part I, p. 32, Silver-Burdett.

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE USE OF THE EXPONENTIAL FORMS OF BASE 10 BY CHANGING TO AND FROM DECIMAL TO EXPANDED NOTATION USING EXPONENTS. 0155

What is correct decimal notation for the following expanded notation using exponents? 0436

$(3 \times 10^3) + (2 \times 10^2) + (1 \times 10^1) + (2 \times 10^1) + (2 \times 10^0)$

a. 32, 122
b. 32, 120
*c. 3,232
d. 3,230
e. 3,222

What is the correct expanded notation using exponents for the decimal notation 5,001. 0437

a. $(5 \times 10^4) + (1 \times 10^1)$
b. $(5 \times 10^3) + (0 \times 10^2) + (1 \times 10^1)$
c. $(5 \times 10^3) + (0 \times 10^2) + (0 \times 10^1) + (1 \times 10)$
*d. $(5 \times 10^3) + (1 \times 10^0)$
e. $(5 \times 10^4) + (1 \times 10^0)$

Which of the following is not a correct notation for two hundred thousand. 0438

a. 2 x 100,000
b. 2 x 10 x 10 x 10 x 10 x 10
c. 2×10^5
*d. 0.00002
e. 200,000

Source: Found. of Secondary School Math—Part I, pp. 31,32
Silver Burdett.

THE STUDENT WILL SHOW HIS UNDERSTANDING OF ROUNDING AND WRITING NUMBERS IN EXPONENT FORM BY USING THESE CONCEPTS TO FIND THE SOLUTIONS TO WORD PROBLEMS. 0167

The earth's average diameter (distance through) is about 7918 miles. The diameter of the sun is about 109 times the diameter of the earth.

What is the diameter of the sun rounded to the nearest hundred thousand miles and expressed as a whole number times a power of 10?

* a. 8×10^5
b. 8×10^6
c. 9×10^6
d. 9×10^5
e. 87×10^4

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO ADD POLYNOMIALS BY SELECTING THE CORRECT POLYNOMIAL SOLUTION. 0015

Which of the following is the sum of $5x^4 + 20x^2 + 3x$ and $12x^3 + 6x + 4$? 0019

a. $17x^4 + 26x^2 + 7x$
b. $5x^4 + 32x^3 + 9x + 4$
*c. $5x^4 + 12x^3 + 20x^2 + 9x + 4$
d. $17x^3 + 20x^2 + 9x + 4$
e. none of the above

Source: Advancing in Mathematics, SRA, part 10.

THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF POLYNOMIALS BY DETERMINING THE COEFFICIENT AND THE DEGREE OF A POLYNOMIAL. 0076

In the monomial $3\,y^4$ the 0127

a. degree is 3 and the coefficient is 4
*b. degree is 4 and the coefficient is 3
c. degree is 12 and the coefficient is 4
d. degree is 7 and the coefficient is 4
e. none of the above

In the monomial $5y^2\,x^3$ the 0128

a. degree is 2 and the coefficient is 3
b. degree is 10 and the coefficient is 6
c. degree is 5 and the coefficient is 5
d. degree is 3 and the coefficient is 2
*e. degree is 6 and the coefficient is 5

Source: Dolciani, Algebra 1, Chapter 2.

The earth's circumference (distance around) at the equator is about 24,902 miles. 0495

What is the circumference of the earth rounded to the nearest thousand miles and expressed as a whole number times a power of ten?

a. 24×10^3
b. 25×10^3
c. 2×10^4
d. 20×10^4
e. 20×10^3

Source: Silver-Burdett, Found. of Secondary School Math--Part I

THE STUDENT WILL DEMONSTRATE HIS KNOWLEDGE OF THE BASIC OPERATIONS BY SOLVING PROBLEMS WITH NUMBERS WRITTEN AS THE SUM OF MULTIPLES OF THE POWERS OF 10. 0174

Whole numbers can be written as the sum of multiples of powers of ten. Using this method of writing numbers solve 10 + 2
300 + 80 + 4 and select the statement which is not true about your solution. 0516

*a. The answer is written 32
b. The first subtraction is (300 + 60) from (300 + 80)
c. The multiples of ten are all in one column
d. The units are all in one column

THE STUDENT CAN SHOW HIS UNDERSTANDING OF POWERS BY CONVERTING THE FORMULA TO A NUMBER SENTENCE OR BY CONVERTING THE NUMBER SENTENCE TO A FORMULA. 0249

Which formula indicates $y \cdot y \cdot y \cdot y \div y \cdot y = y \cdot y$ 0653

a. $y^m \cdot y^n = y^{m+n}$
b. $(y^m)^n = y^{m \cdot n}$
*c. $\frac{y^m}{y^n} = y^{m-n}$

Which number sentence demonstrates the formula $(y^m)^n = y^{m \cdot n}$ 0654

*a. $(3 \times 3)^5 = 3^{2 \cdot 5} = 3^{10}$
b. $(3 \times 3 \times 3) \times (3 \times 3) = 3^3 \times 3^2 = 3^5$
c. $(3 \times 3 \times 3) \div (3 \times 3) = 3^3 \div 3^2 = 3^1$

GRAPHS AND CHARTS

THE STUDENT IS ABLE TO ANALYZE A CHART, TABLE, DRAWING, ETC., CONSTRUCTED ON THE BASIS OF VARIOUS MATHEMATICAL PHENOMENA AND STATE SPECIFIC INFORMATION AND GENERAL CONCLUSIONS IN THE FORM OF RELATIONSHIPS. 0099

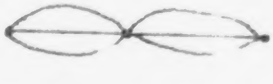
From the following table referring to the faces (F), vertices (V), and edges (E) of various polyhedrons, state the relationship that appears to exist regarding F, V, and E. 0217

F	V	E
4	4	6
5	6	9
6	8	12
6	6	10

* $(F + V - 2 = E)$

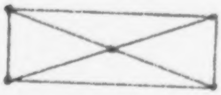
Directions: Below is a set of eight drawings. They represent networks or pathways. Some can be traced, some cannot.

*a. can be traced
b. cannot be traced



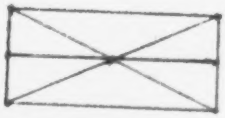
0218

a. can be traced
*b. cannot be traced



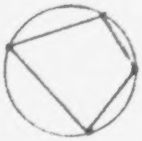
0219

a. can be traced
*b. cannot be traced



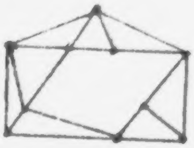
0220

*a. can be traced
b. cannot be traced

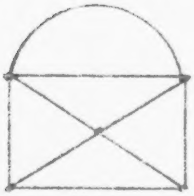


0221

a. can be traced
*b. cannot be traced

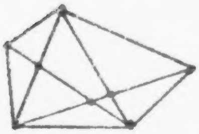


0222



*a. can be traced
b. cannot be traced

0223



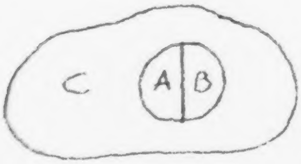
*a. can be traced
b. cannot be traced

0224

Directions: In coloring a map it is customary to color countries that share a common border different colors. Referring to the maps, choose the least number of colors needed to color the map.

Map 1

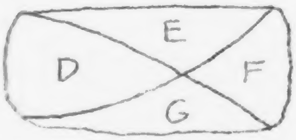
a. 1
b. 2
*c. 3
d. 4



0225

Map 2

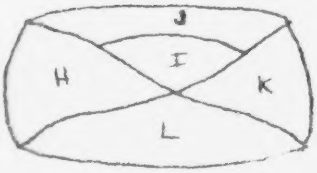
a. 1
*b. 2
c. 3
d. 4



0226

Map 3

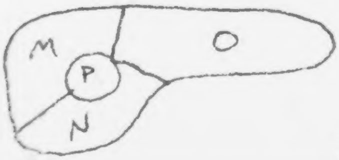
a. 2
*b. 3
c. 4
d. 5



0227

Map 4

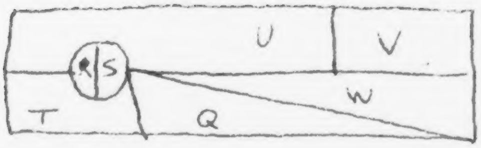
a. 2
b. 3
*c. 4
d. 5



0228

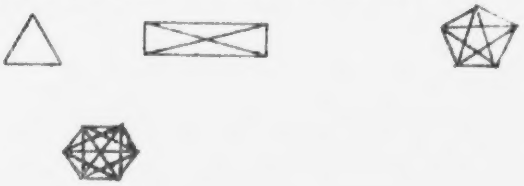
Map 5

*a. 4 0229
b. 5
c. 6
d. 7



In the polygons below, diagonals have been drawn. From your study of these drawings can you predict the number of diagonals it is possible to draw in an 8-sided polygon?

a. 8 0230
b. 10
*c. 20
d. 28



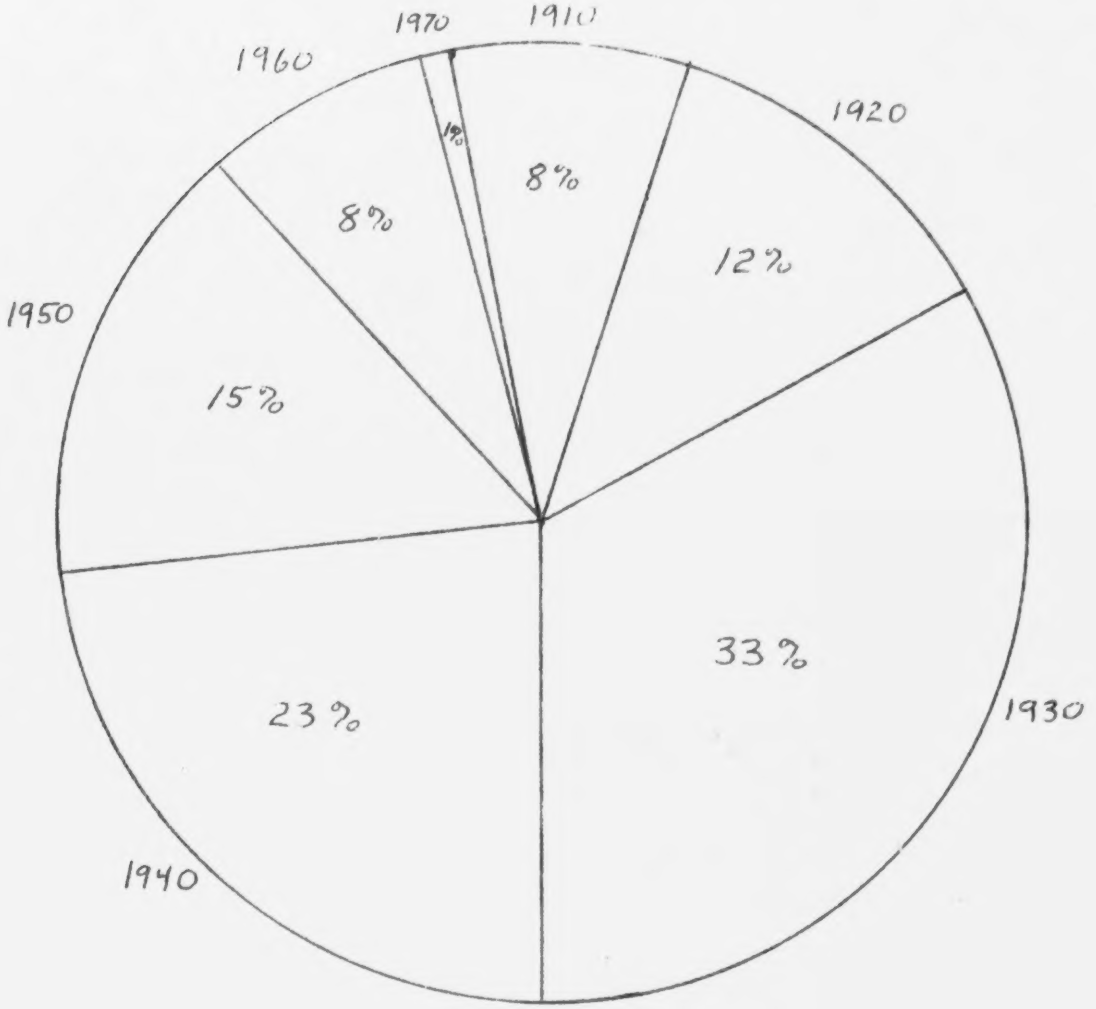
Which of the following can you write a general rule to determine the number of diagonals of a polygon of any number of sides.

Directions: Choose the response below that expresses your answer to this question. (n represents number of sides in each polygon)

a. $n\ (n - 1)$ 0231
b. $n + (n + 0) + (n - 2) + (n + 0) + \dots$
*c. $\frac{n\ (n - 3)}{2}$
d. $\frac{n\ (n - 2)}{2}$
e. cannot write a general rule

THE STUDENT CAN INTERPRET A CIRCLE GRAPH AND INDICATE THE PERTINENT FACTS AND CHANGE THEM TO A DIFFERENT KIND OF GRAPH. 0257

Total Contributions 31,670,000



1969 Contributions to the Building Fund of Fabulous University by Alumni from the graduating classes of 1910 to 1970

From the above graph:

Figure the dollar contributions of 1930. 0670

*a. $551,100
b. $735,310
c. $55,110
d. none of these

Which is the median year of contributions? 0671

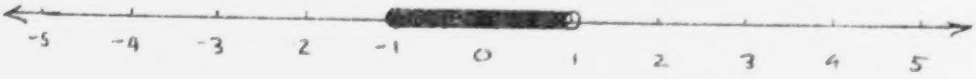
a. 1920
b. 1930
*c. 1940
d. 1950

In changing this graph to a bar graph with the years at the base of the graph, what will the vertical values be? 0672

a. years
b. percentage
*c. dollars
d. none of these

THE STUDENT CAN DEMONSTRATE AN UNDERSTANDING OF GRAPHS BY DRAWING THE GRAPH OF A SET OF NUMBERS. 0071

Which rule describes the set whose graph is shown below? 0112

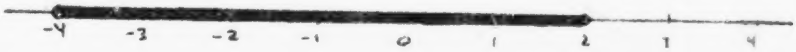


a. {the real numbers less than -1 and greater than 1}
b. {the positive real numbers greater than -1}
*c. {the real numbers that are greater than or equal to -1 and less than 1}
d. {the rational numbers that are greater than -1 and less than 1}
e. {the integers greater than or equal to -1 and less than 1}

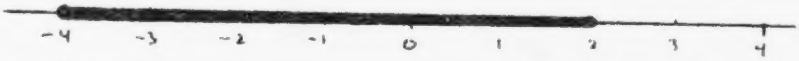
Source: Dolciani - Algebra I, Chapter.

Which graph shows the set of integers that are greater than -4 and less than 2? 0113

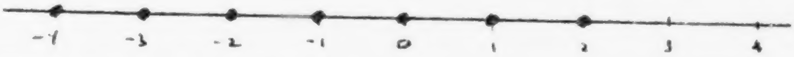
a.



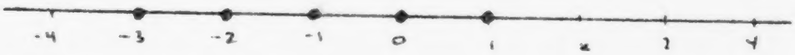
b.



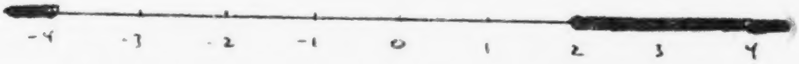
c.



*d.



e.

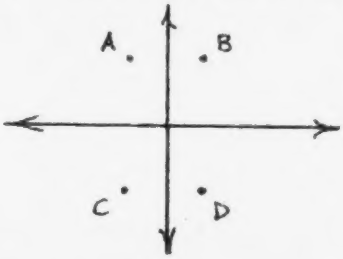


Source: Dolciani - Algebra I, Chapter 1.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS ABILITY TO LOCATE A NUMBER PAIR ON A GRAPH BY IDENTIFYING THE CORRECT POINT (ON A GRAPH) WHICH REPRESENTS A GIVEN NUMBER PAIR. 0030

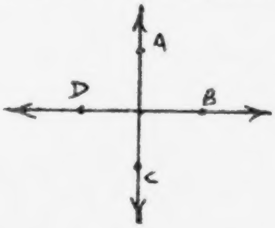
Choose the point on the graph which represents the number pair $(^-3,5)$ 0043

- *a. point A
- b. point B
- c. point C
- d. point D



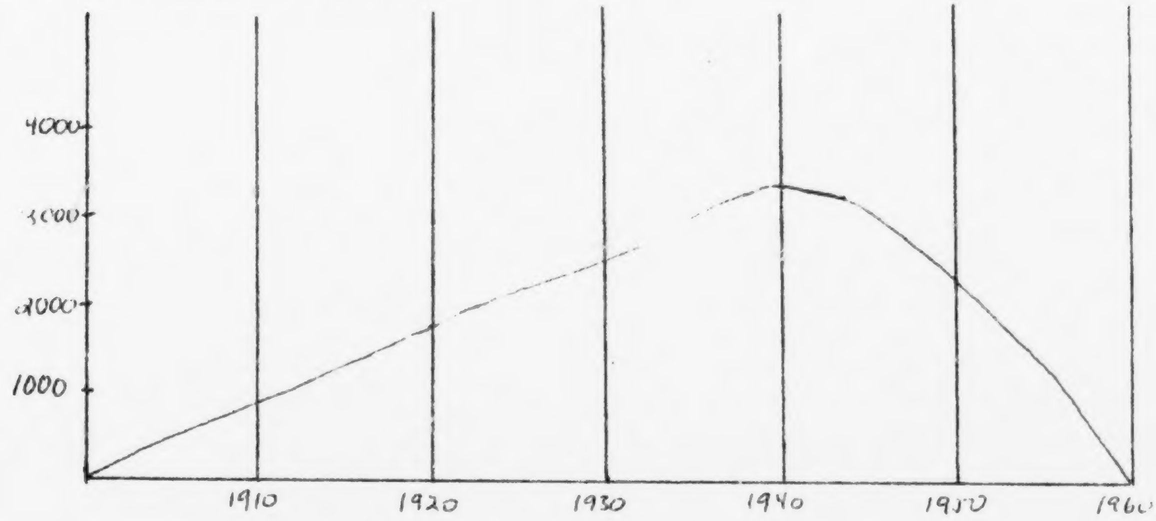
Choose the point on the graph which represents the number pair $(0, ^-4)$. 0044

- a. point A
- b. point B
- *c. point C
- d. point D



Source: School Mathematics, II, p. 63, 64.

THE STUDENT CAN COMPREHEND GRAPHS BY IDENTIFYING ONE COORDINATE WHEN GIVEN THE OTHER. 0246



The Production of Hootenanys

Using the above graph, in approximately what year was the maximum production of Hootenanys? 0647

a. 1910
b. 1920
c. 1930
*d. 1940
e. 1950

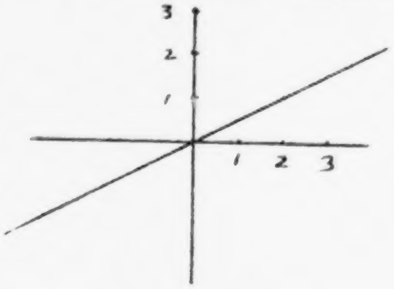
How many Hootenanys were produced in 1920? 0648

*a. 1800
b. 3200
c. 2800
d. 800

THE STUDENT WILL BE ABLE TO RECOGNIZE THE GRAPH OF A LINEAR RELATION IN ONE OR TWO VARIABLES AND SHOW THIS BY MATCHING A RELATION TO A GRAPH. 0101

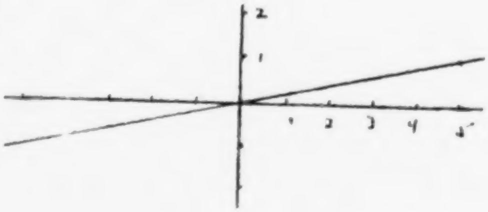
Directions: To the right of each graph are five choices. Choose the relation that describes best the graph. The domain is the set of real numbers.

a. $\{(x,y): y = x\}$
b. $\{(x,y): y = 2x\}$
*c. $\{(x,y): 2y = x\}$
d. $\{(x,y): y = x + 2\}$
e. none of the above



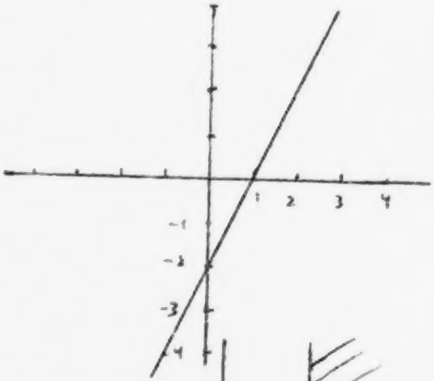
0241

a. $\{(x,y): y = \frac{x}{5}\}$
b. $\{(x,y): 25y = 5x\}$
c. $\{(x,y): 5y = x\}$
d. $\{(y,y): .5y = \frac{x}{10}\}$
*e. { all of the above



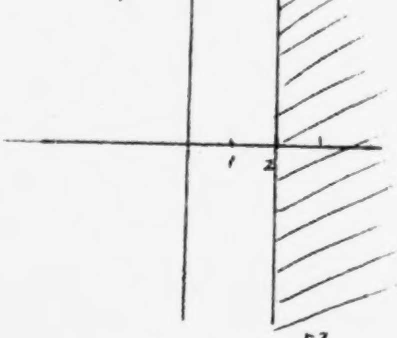
0242

a. $\{(x,y): y = 2x-2\}$
b. $\{(x,y): y = 2x +1\}$
*c. $\{(x,y): y = 2x - 2\}$
d. $\{(y,y): y = 2x + 1\}$
e. none of the above



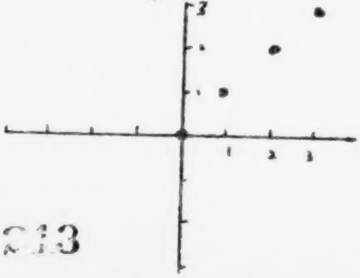
0243

a. $\{(x,y): x = 2\}$
b. $\{(x,y): x = 2\}$
c. $\{(x,y): y = -2\}$
d. $\{(x,y): x = -2\}$
*e. none of the above

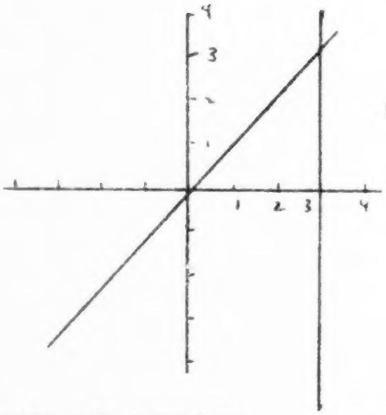


0244

a. $\{(x,y): x = y$, x is an integer$\}$
b. $\{(x,y): x = -y$, x is an integer$\}$
c. $\{(x,y): x = y$, x is a whole number$\}$
*d. $\{(x,y): x = y, x = 0, 1, 2, 3\}$
e. none of the above



0245



a. $\{(x,y): x = y, x \text{ is a real number}\}$ 0246

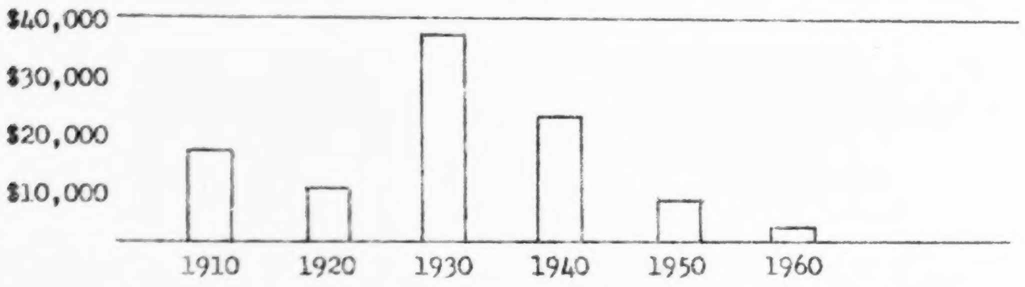
b. $\{(x,y): x = e, x \text{ is a real number}\}$

*c. $\{(3,3)\}$

d. $\{(0,0),(1,1),(2,2),(3,3)\ldots\}$

e. none of the above

THE STUDENT CAN EVALUATE THE ANALYSIS OF A GRAPH AND IDENTIFY AMONG GOOD ANALYSES THAT ONE WHICH WOULD MOST COMPLETELY COVER THE CAUSE OF THE DISTRIBUTION. 0256



1969 Contributions to a university by graduating classes

One could conclude from the above graph all of the following. Choose the best among possibly good conclusions. Of these alumni, the greatest contribution was made by the alumni of the class of 1930 because 0669

a. they had achieved their maximum earnings.
b. their expenses were at their minimum.
c. their love of their alma-mater was the greatest.
*d. the proportion of their earnings to their expenses was the greatest.

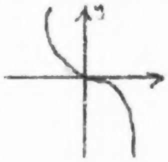
THE STUDENT WILL DEMONSTRATE AN UNDERSTANDING OF QUADRATIC FUNCTIONS BY DRAWING THE GRAPH OF A QUADRATIC FUNCTION. 0082

The graph of an equation of the form $ax^2 + bx + c$ where a 0 is a (n) 0141

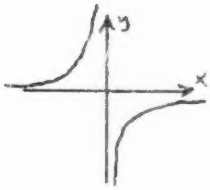
a. hyperbola
*b. parabola
c. line
d. ellipse
e. none of the above

If $a > 0$, the graph of the equation $ax^2 + bx + c$ would look like 0142

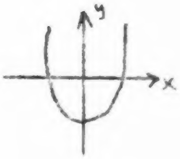
a.



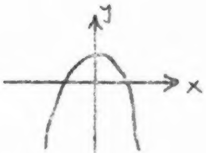
b.



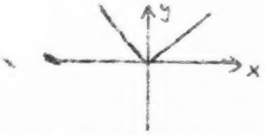
* c.



d.

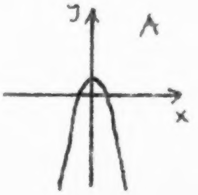


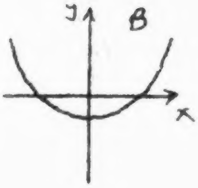
e.



If B and A are drawn to the same scale and B is broader than A, which equation would have the broader graph? 0143

a. $y = 2x^2 + 3x + 1$
*b. $y = \frac{1}{16}x^2 + x + 2$
c. $y = -4x^2$
d. $y = x^2 + x - 2$
e. $y = -\frac{1}{8}x^2 - 3x + 2$





Directions: For the following items assume you are about to prepare a table of values in order to draw the graph of $y = -2x^2 + 3x - 1$

If x = -3, what is the corresponding value of y? 0144

a. 26
b. -10
c. -1
d. 28
*e. -28

If x = 0, what is the corresponding value of y? 0145

a. 3
*b. -1
c. 0
d. 4
e. 2

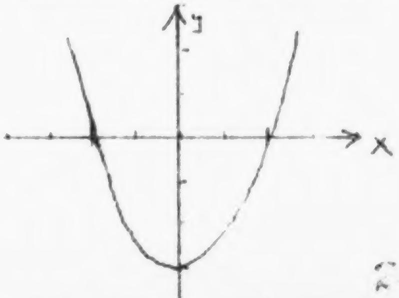
If x = 2, what is the corresponding value of y? 0146

*a. -1
b. 13
c. 9
d. -15
e. 1

THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF QUADRATIC FUNCTIONS BY FINDING THE MINIMUM (MAXIMUM) POINT OF THE GRAPH OF A QUADRATIC FUNCTION. 0083

What are the coordinates of the maximum (minimum) point? 0147

a. (0,2)
b. (-2,0)
c. (-3, 0)
*d. (0, -3)
e. (3, 0)



If (x,y) is the vertex of the graph of $2x^2 - 3x + 4$ than (x, y) is the 0148

a. maximum point
b. point of symmetry
*c. minimum point
d. none of the above

THE STUDENT WILL DEMONSTRATE UNDERSTANDING OF THE AXIS OF SYMMETRY BY FINDING THE EQUATION OF THE AXIS OF SYMMETRY OF A PARABOLA. 0084

What is the equation of the axis of symmetry of the graph of $x^2 + 3x - 10$? 0149

a. $y = 3.5$
b. $y = -1.5$
c. $x = 1.5$
d. $x = .5$
*e. $x = -3.5$

Which parabola does not have the graph of $x = 1$ as its axis of symmetry? 0150

a. $y = x^2 - 2x$
*b. $y = x^2 + 2x - 8$
c. $y = x^2 - 2x - 8$
d. $y = x^2 - 2x - 3$
e. none of the above

THE STUDENT WILL ANALYZE A GIVEN SET OF HYPOTHESES ABOUT A SEGMENT JOINING TWO SPECIFIED POINTS AND ITS RELATION TO A SIMPLE CLOSED CURVE BY SELECTING A VALID HYPOTHESIS FOR TWO GIVEN POINTS. 0227

Directions: Given these five statements about line segment $\overline{AB}$ and a simple closed curve, select for each item below the one statement which will be true for all situations described in the item.

a. $\overline{AB}$ will not intersect the boundary of the curve.
b. $\overline{AB}$ will intersect the boundary of the curve either once or not at all.
c. $\overline{AB}$ will intersect the boundary of the curve either an odd number of times or not at all.
d. $\overline{AB}$ will intersect the boundary of the curve either twice or not at all.
e. $\overline{AB}$ will intersect the boundary of the curve either an even number of times or not at all.

e Points A and B are both on the interior of the simple closed curve. 0597

e Points A and B are both exterior points relative to the simple closed curve. 0598

c Point A is an interior point; Point B is an exterior point. 0599

c Point B is an interior point; Point A is an exterior point. 0600

THE STUDENT WILL DEMONSTRATE HIS UNDERSTANDING OF THE DEFINITIONS OF CONCAVE AND CONVEX SIMPLE CLOSED CURVES BY SELECTING FROM A LIST APPLICABLE GENERALITIES ABOUT A GIVEN SITUATION. 0228

Directions: For the items below, select the one rule listed which will always be true for the situation stated but which will not contain any superfluous possibilities.

Given the simple closed curve as described and points A and B as described, AB could cross the boundary of the curve:
a. never
b. once only
c. either never or twice only
d. either never or an odd number of times
e. either never or an even number of times

TYPE OF SIMPLE CLOSED CURVE	LOCATION POINT A	LOCATION POINT B	CORRECT RULE	
convex	interior	interior	*a b c d e	0601
convex	interior	exterior	a *b c d e	0602
convex	exterior	exterior	a b *c d e	0603
concave	interior	interior	a b c d *e	0604
concave	interior	exterior	a b c *d e	0605
concave	exterior	exterior	a b c d *e	0606
any type	interior	interior	a b c d *e	0607
any type	interior	exterior	a b c *d e	0608
any type	exterior	exterior	a b c d *e	0609

THE STUDENT WILL APPLY HIS KNOWLEDGE OF SIMPLE CLOSED CURVES TO A NEW SITUATION - 3 DIMENSIONAL SPACE - AND DEMONSTRATE APPLICATION BY SELECTING FROM A LIST A FIGURE THAT OPERATES ON SPACE POINTS THE SAME WAY THE SIMPLE CLOSED CURVE OPERATES ON PLACE POINTS. 0235

The student knows that in a plane a simple closed figure is one that divides the plane into two distinct regions - an inside and an outside. Which of the following sets of points would divide all the points in space into analogous regions? 0627

a. the set of points which make up all surfaces of a water glass.
b. the set of points which make up an endless, curved line.
c. the set of points which make up a plane.
*d. the set of points which make up the surfaces of a rectangular solid.
e. the set of points which make up the surface of a tube.

SEQUENCES

THE STUDENT CAN DISTINGUISH A PATTERN IN A SET OF NUMBERS BY IDENTIFYING THE FIFTH MEMBER OF A SET AFTER BEING GIVEN THE FIRST FOUR MEMBERS. 0047

Because of the pattern involved, what would be the next member of this set? 1, 5, 9, 13, ... 0065

a. 15
b. 16
*c. 17
d. 18
e. none of the above

Because of the pattern involved, what would be the next member of this set? 1, 2, 4, 8, ... 0066

a. 10
b. 12
c. 14
*d. 16
e. none of the above

Because of the pattern involved, what would be the next member of this set? 1, 4, 9, 16, ... 0067

a. 20
b. 21
c. 23
*d. 25
e. none of the above

Because of the pattern involved, what would be the next member of this set? 1, 8, 27, 64, ... 0068

a. 81
b. 87
c. 100
*d. 125
e. none of the above

Source: S.R.A. Advancing in Mathematics, part 2.

THE STUDENT WILL BE ABLE TO DEMONSTRATE HIS KNOWLEDGE OF THE PATTERN IN THE SET OF TRIANGULAR NUMBERS BY IDENTIFYING TWO OF ITS MEMBERS. 0059

Which of the numbers 10, 21, 35, 44 are triangular numbers? 0087

a. 10, 35
*b. 10, 21
c. 21, 35
d. 21, 44
e. 10, 44

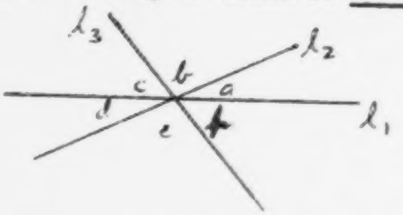
Source: School Mathematics, II, p. 121.

ANGLES AND TRIGONOMETRY

THE STUDENT WILL RECALL THE ANGLE TYPES BY NAMING THE TYPES OF ANGLES FORMED BY THREE COPLANAR LINES AND RECOGNIZE THEIR PROPERTIES. 0092

In the sketch at the right, two adjacents angles would be ________. 0181

a. a and d
b. d and f
c. c and f
*d. a and b
e. none of the above

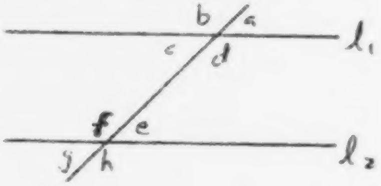


Two angles that have a common vertex and a common side between them are called ________. 0182

*a. adjacent
b. opposite
c. supplementary
d. equivalent
e. none of the above

In the sketch at the right, l_1 and l_2 are parallel. Angles a and e are ________. 0183

a. exterior
*b. corresponding
c. opposite
d. adjacent
e. none of the above



Opposite angles are always ________. 0184

*a. congruent
b. acute
c. obtuse
d. adjacent
e. none of these

A pair of corresponding angles cannot be a pair of ________ angles. 0185

a. acute
b. supplementary
*c. adjacent
d. congruent
e. none of the above

Three coplanar lines may not have __________ points of intersection. 0186

a. 0
b. 1
c. 2
d. 3
*e. none of the above

A linear pair of angles may be ________ angles. 0187

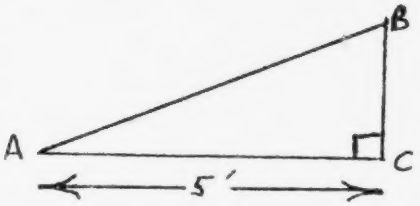
a. corresponding
b. acute
*c. congruent
d. opposite
e. none of the above

Source: Seeing Through Math, Scott, Foresman pp. 450-4.

THE STUDENT WILL BE ABLE TO APPLY TRIGONOMETRIC RATIOS AND THE PYTHAGOREAN THEOREM, IN SOLVING PROBLEMS DEALING WITH AREA AND VOLUME OF GEOMETRIC FIGURES. 0095

Knowing the measure of angle A in the drawing will help to find directly the measure of side _________. 0205

a. $\overline{AB}$
b. $\overline{BC}$
c. $\overline{AC}$
*d. $\overline{AB}$ and $\overline{BC}$

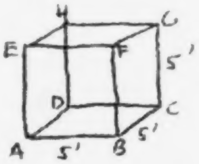


The shadow of a 50 ft. high building is 20 ft. The shadow of a flag pole is 8 ft. The height of the flag pole is ________. 0206

- a. 3.2 ft.
- b. 125 ft.
- *c. 20 ft.
- d. none of these

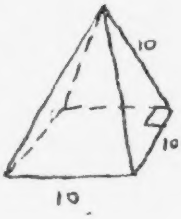
The area of rectangle ACGE in the cube below is __________. 0207

- *a. 25 2 sq. ft.
- b. 25 sq. ft.
- c. 20 sq. ft.
- d. 10 + 10 2 sq. ft.



The surface area of a right square pyramid sketched below is __________. 0208

- a. $100\sqrt{3}$ sq. units
- b. $100 + 200\sqrt{3}$ sq. units
- c. $300\sqrt{3}$ wq. units
- *d. $100 + 100\sqrt{3}$ sq. units



The volume of the pyramid in the above item is____________. 0209

- *a. $\frac{500}{3}\sqrt{2}$ cu. units
- b. $500\sqrt{2}$ cu. units
- c. $1500\sqrt{2}$ cu. units
- d. $\frac{200}{3}\sqrt{2}$ cu. units

PROBABILITY, COMBINATIONS AND PERMUTATIONS

THE STUDENT WILL DEMONSTRATE KNOWLEDGE OF COMBINATIONS AND PERMUTATIONS BY APPLYING THE PERMUTATION AND COMBINATION FORMULAS TO NEW SITUATIONS. 0098

How many inscribed quadrilaterals are determined by nine points on a circle? 0214

a. 24
b. 36
*c. 126
d. 3024

What is the greatest number of lines determined by seven points? 0215

a. 14
*b. 21
c. 28
d. 35

If the first two letters of the call sign of a television must be WJ, how many call signs of four different letters are possible? (Use only the English alphabet). 0216

a. 256
b. 325
*c. 512
d. 650

Source: Seeing Through Math, Van Engen et al, Chapter 15.

THE STUDENT CAN RECOGNIZE THE MEANING OF TERMS INVOLVED IN PROBABILITY BY IDENTIFYING THE MEANING OF TERMS. 0242

Mark the correct term for the following meaning: "the set of all possible outcomes." 0640

a. experiments
*b. sample space
c. probability
d. event

Mark the correct meaning for the following term: "probability." 0641

*a. how likely nature
b. activities
c. set of all possible outcomes
d. one action

Source: Nichols, 8 Mathematics Patterns & Structures, Holt.

THE STUDENT CAN RECALL THE TERMS USED IN ANALYZING TEST SCORES BY IDENTIFYING MEANINGS OR TERMS. 0243

Mark the correct term for the following meaning - "the number that occurs most often." 0642

a. mean
*b. mode
c. median
d. range

Mark the correct meaning of the following term - "median." 0643

*a. the number above which and below which there is the same number of numbers.
b. the number that occurs most often.
c. the sum of the numbers divided by the number of numbers.
d. the set of numbers from the highest to the lowest, or from the lowest to the highest.

THE STUDENT CAN APPLY HIS UNDERSTANDING OF FREQUENCY PROBABILITY BY IDENTIFYING THE PROBABILITY IN GIVEN SITUATIONS. 0244

Given 2 dice the gambler has a set chance of making any given combination. What chance does he have to roll a seven or an eleven? (remember he has two chances to roll each combination [1 black and 6 red] and [1 red and 6 black]) 0644

*a. $\frac{2}{9}$

b. $\frac{1}{9}$

c. $\frac{1}{18}$

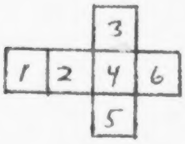
d. $\frac{4}{9}$

SPATIAL PERCEPTION

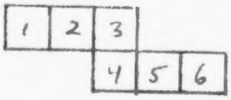
THE STUDENT WILL ANALYZE A SET OF PLANE FIGURE AND SELECT FROM A LIST THE ONE WHICH CANNOT FORM A GIVEN THREE-DIMENSIONAL OBJECT. 0224

Which plane figure below could not be folded to make this cube: 0593

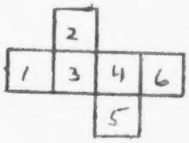
a.



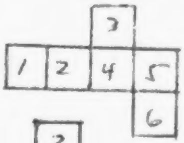
*b.



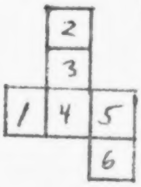
c.



d.



e.

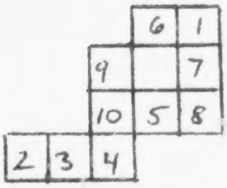


Using the plane figures in the above item, select the statement that is true below. 0594

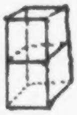
a. In (a), squares 1 and 6 would overlap.
*b. In (b), squares 1 and 6 would overlap.
c. In (c), squares 1 and 6 would overlap.
d. In (d), squares 1 and 6 would overlap.
e. In (e), squares 1 and 6 would overlap.

THE STUDENT WILL ANALYZE A PLANE FIGURE AND SELECT FROM A LIST A TRUE STATEMENT ABOUT THE FIGURE'S APPEARANCE WHEN IT IS FOLDED UP TO MAKE A RECTANGULAR SOLID. 0225

When this figure



is folded correctly, 0595



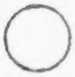
it makes a rectangular solid which looks like this:
(Hint: 1 is an end piece.)
Select the statement below which is true about the plane figure when it is folded as shown?

a. squares 2 and 7 will be on the same side
b. squares 4 and 5 will be on the same side
c. squares 3 and 4 will be on the same side
d. squares 4 and 10 will be on the same side
*e. squares 5 and 6 will be on the same side

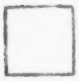
THE STUDENT WILL DEMONSTRATE COMPREHENSION OF THE SHAPES OF SOLID FIGURES BY SELECTING FROM A LIST A PLANE VIEW OF EACH FIGURE NAMES. 0231

Directions: The following plane figures can be thought of as views from the top of solid figures. Match the plane figures with the solid figures they could possibly be.

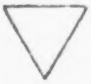
a.



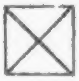
b.



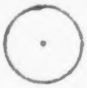
c.



d.



e.



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